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COVER PICTURE
Circular sheep yards on the Esperance Research Station.

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RICE GROWING IN THE ORD RIVER VALLEY

By E. C. B. LANGFIELD*

THE first commercial rice crop in the Ord River Valley was planted late in 1960 and plans are in hand for some 35,000 acres of land to be subdivided for irrigation settlement by 1964, with rice as a major crop.

This development has been made possible as a result of experimental work at the Kimberley Research Station, where since 1947 experimental plots have been planted to rice. As one might expect, the work involved in finding how to grow this crop successfully in an isolated area such as this, has been fraught with many difficulties. Although some problems still remain, enough information has been gathered now for farmers to grow rice with a fair chance of success. With careful husbandry yields of from one to two tons an acre can be achieved, and there

Bulk rice plot: Seed increase and farm-scale test of a variety almost ready for commercial production

* The author is a member of the Division of Land Research and Regional Survey, C.S.I.R.O., and was stationed at the Kimberley Research Station from 1947 until his transfer in 1959 to the Coastal Plains Research Station Darwin.

Variety trial: The centre plot contains an early-maturing variety, with grain-filled heads beginning to mature.

is scope for considerable improvement as further experience accumulates. Some experimental plots have yielded well above two tons an acre.

Rice cultivation has distinct advantages on the heavy Cununurra clay, which will be the main soil type in the area to be irrigated. This soil does not drain easily so other crops are likely to suffer from waterlogging, particularly during the summer monsoon season. On the other hand the impermeability of the soil is an advantage for growing rice.

The research station has shown that it is possible to grow rice on an experimental scale in the northern Kimberleys at any time of the year. However, land preparation, sowing and harvesting are impracticable on a farm scale during the heavy rains between December and early April. Consequently, commercial rice growing will be confined to two distinct seasons, wet season rice sown during the early rains and harvested in the early dry season and dry season rice sown after the rains and harvested before the next wet season. Different types of rice must be grown in each season.

In most tropical rice-growing areas the crop is cultivated by hand. However, in temperate regions such as parts of the U.S.A. and the Murrumbidgee Irrigation Areas in N.S.W., large-scale mechanised rice growing is well established. When the research programme began in the Kimberleys the main task confronting the scientists was to combine the experience from both tropical and temperate zones into a rice farming system in keeping with Australian working conditions. As the environment in many other parts of northern Australia is similar to that of the Kimberleys, the station's achievements have had wide application. Some of the results have already proved helpful to rice producers in the western Kimberleys and near Darwin in the Northern Territory.

VARIETIES

The majority of cultivated rice varieties belong to two main groups, *indica* and *japonica*. The former are confined to tropical and sub-tropical regions while the latter are grown mainly in temperate environments. There are wide differences in the grain and straw between the varieties within each group. In general, the grain of *indica* varieties is long and slender. It also tends to be flinty and remains firm after cooking. The grain of *japonica* varieties tends to be short and broad and after cooking it tends to disintegrate and to become soft and glutinous. The majority of tropical peoples prefer the *indica* type of grain while Japanese prefer the *japonica* type. Both can be sold on European and American markets although the long-grained, firm cooking rices command higher prices. At present the Australian market is supplied almost entirely by *japonica* type rice grown in the Murrumbidgee Irrigation Areas.

The straw characteristics of different varieties are important if the crop is to be harvested mechanically. In general, *indica* varieties are tall and weak-strawed and likely to lodge, particularly when nitrogen supply is plentiful. On the other hand the straw of *japonica* varieties is usually shorter and stronger and easier to harvest by machine.

The Kimberley Research Station has shown that *indica* varieties are better suited to growing in the wet summer season and *japonica* varieties to the dry winter season. It has also been found that the behaviour and performance of many varieties depend on the actual date of planting. Recently, a study was carried out at the Station of the behaviour of 17 rice varieties after they had been planted at fortnightly intervals throughout the year. This work showed that different varieties respond according to the times they are planted, due to seasonal changes in temperature and length of daylight. As a result they came into flower at definite dates although the planting dates varied widely. This characteristic is of value on Cununurra clay as it enables land preparation and planting to be carried out before the heavy rains of summer, and harvesting to take place when most of the rains have passed. In other varieties flowering appeared to be controlled mainly by temperature and the time between their sowing and flowering was more uniform.

These studies have shown also that the effect of the planting date on the percentage of sterile spikelets differs in different varieties. In some of them the amount of sterility is low and appears to be independent of the planting date. In others it varies from very little to over 90 per cent. The causes of spikelet sterility are not fully understood but it appears that temperature and day length (in the case of photoperiodic varieties) are both important to satisfactory flowering.

Of over 300 *indica* varieties tested so far at the research station, an African variety, Meli No. 2 has proved to be one of the most suitable. It is strongly photoperiodic so that if planted any time between late July and the end of January it flowers in the following April. If it is planted at other times individual tillers flower independently and the proportion of sterile spikelets is high. This means that it is unsuitable to plant it in the early dry season. Between late October and the end of November is the most suitable time to plant it. Although other wet season varieties have given similar yields, Meli No. 2 has a slightly superior straw strength.

In general, weak straw is a problem with *indica* varieties. Cross-breeding experiments between *indica* and *japonica* rice varieties have been undertaken at the Central Rice Research Institute in India in an attempt to combine the superior straw characteristics of the *japonica* varieties with the climatic adaptation and grain characteristics of *indica* varieties. Hybrid strains have been received from India and are now being selected at the Kimberley Research Station.

Caloro, the main variety grown in the Murrumbidgee Irrigation Areas, is at present regarded as the standard dry season variety for the Ord Valley. Greenhouse studies conducted by Dr. E. Phillis in Canberra indicate that this variety is thermoperiodic, that is, its flowering is controlled by temperature. When it is sown early in the dry season at the Kimberley Research Station Caloro ears in about 80 days and matures some 40 days later. Fewer *japonica* varieties than *indica* varieties have been examined but work is in progress which might lead to more varieties being recommended.

Because different markets demand different types of grain the final choice of varieties to be produced in the Ord Valley depends not only on their adaptation to the local environment but also on the future markets.

LAND PREPARATION AND PLANTING

The methods of land preparation are similar to those common in the Murrumbidgee Irrigation Areas. They consist of an initial ploughing followed by cultivation, grading and levelling, pre-irrigation and a final pre-planting cultivation.

Direct experimental evidence is still lacking but general experience indicates that ploughing as soon as possible after a wet season crop has been harvested reduces subsequent stem-borer attack by

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thoroughly drying soil that may be infested with stem-borers in their overwintering form. Ploughing is carried out to the depth of four to six inches, but deeper ploughing may prove worthwhile if weeds become a problem.

To obtain a tilth suitable for grading and levelling, ploughed land is disc-harrowed or tilled with a tine cultivator. Grading and levelling follow. Proper subdivision of the rice fields into irrigation bays and proper grading within bays is of considerable importance. The differences in water levels over a flooded bay should not exceed two inches. Careful levelling is important to avoid small local depressions.

A few weeks after germination rice should be flooded, but at the seedling stage it can be killed by prolonged submersion. This often occurs in depressions on poorly graded land after early irrigations. In addition, shallow ponds attract water birds which puddle in them and cause further damage.

It is important to pre-irrigate the bays if early rains do not germinate weeds. The young weeds can then be destroyed by cultivation before sowing. Research in progress on weed control measures may change this situation but these practices are the most satisfactory for the present time.

Apart from destroying weeds the final cultivation also is used to prepare a suitable seed-bed. Too fine a seed bed leads to soil slaking and crusting after the first post-planting irrigation. This hampers emergence. The final cultivation must be sufficiently deep for nitrogenous fertilisers to be placed deeply and it has been found that this is also easier if the seed bed is not too fine.

The seeds are planted with a standard drill, about one inch below the soil surface. With the varieties recommended at present, a seeding rate of 100 lb. per acre has proved satisfactory. On clean, well-prepared land, lower rates may be sufficient, but they make the crop more susceptible to early weed competition.

FERTILISERS

Both phosphatic and nitrogenous fertilisers are essential for satisfactory rice crops in the Ord Valley. The residual value of phosphatic fertilisers has not been fully investigated but applications of up to 2 cwt. per acre of superphosphate have increased rice yields not only on

Fertiliser Trial: Experiments have shown that rice needs both phosphatic and nitrogenous fertilisers for good yields in the Ord River Valley

virgin land but also on land which has been cropped previously and has received up to 4 cwt. per acre of superphosphate. Further research is needed to show the economic responses from smaller applications of superphosphate.

There is no advantage in applying more than 2 cwt. per acre of sulphate of ammonia to wet season *indica* rice crops. Little if any more grain is produced and the increase in vegetative growth can lead to serious lodging. On the other hand, dry season grown Caloro responds to sulphate of ammonia applications up to 6 cwt. per acre. However, in order to avoid lodging, it is advisable to limit the rate to 4 cwt. per acre.

Sulphate of ammonia has been used as the standard nitrogenous fertiliser, but recent trials have indicated that urea with equivalent quantities of nitrogen is equally effective. The concentration of nitrogen in urea is about twice as high as in sulphate of ammonia and when handling and transport costs are considered the cost per unit of nitrogen is lower for urea. Only pelleted urea should be used, because urea in crystal form absorbs moisture and becomes difficult to handle.

Experiments have shown that placement of sulphate of ammonia three inches below the soil surface increases yields significantly (Table 1).

Current trials indicate that the same is true of urea and that deeper nitrogen placement (6 in.) is of no advantage. On experimental plots the deep placement has been carried out with an ordinary drill as a separate operation just before sowing. However, it is not likely that the farmers would wish to be saddled with the expense of an additional cultural operation and an implement suitable for drilling seed and superphosphate and placing nitrogen fertiliser at the required depth in one operation is required.

Temporary but distinct yellowing, dying-off of leaf tips and tiller mortality has occurred in rice crops about six weeks after emergence. While the symptoms point to nitrogen deficiency, causes of the disorder are still unknown and the effect on yields is difficult to assess. The application of potash, lime and a wide range of minor elements has failed to produce signficant yield responses or to prevent the occurrence of yellowing and leaf tipping.

IRRIGATION

The first irrigation should be given immediately after seeding and any surplus water drained from the bays as soon as possible.

Later in its growth, rice benefits from flooding, but water should not be allowed to stand in the bays when it is in the seedling stage.

It is important, however, that the soil should be kept moist by quick irrigations. An irrigation at the time of emergence is often helpful in assisting young seedlings to break through the surface soil crust.

When the crop is six to eight inches high water is allowed to remain on the bays. The depth of water is increased slowly until it reaches four to six inches, and in order to maintain the water level as constant as possible it is usually necessary to add irrigation water every two to five days.

TABLE 1—EFFECT OF DEEP PLACEMENT OF SULPHATE OF AMMONIA ON YIELDS OF RICE AT KIMBERLEY RESEARCH STATION

Sulphate of Ammonia*		Yield in lb. per acre	
Depth of Placement	Time of Application	Wet season Meli No. 2	Dry season Caloro
3 in.	At seeding	5350	6920
1 in.	At seeding	4410	5440
Surface	At seeding	4360	5370
Surface	Early tillering	4110	4260

* The Meli No. 2 received 2 cwt. per acre sulphate of ammonia and the Caloro 4 cwt. per acre.

In many rice growing areas it is considered that a greater depth is desirable. For example, in the Murrumbidgee Irrigation Area it is common to flood rice to a depth of up to 15 inches. In the preliminary irrigation trials at Kimberley Research Station, no increase in yield was obtained from deeper flooding.

About one month before harvesting (when the grain is in the milky stage) the water is drained off to allow the soil to dry out sufficiently to carry the harvesting machinery.

Measurements indicate that a wet season rice crop needs some five to six feet of irrigation water in addition to rainfall. The requirements of dry season rice, grown during the cool part of the year and maturing more quickly, are lower and are of the order of four to five feet.

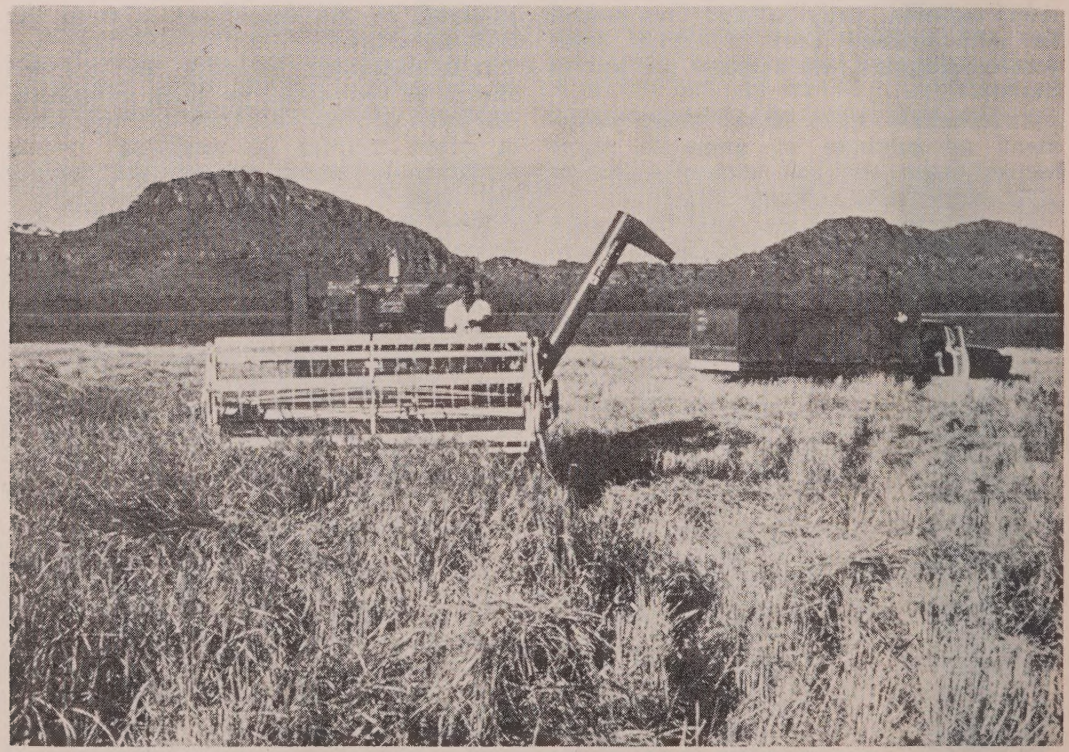
HARVESTING

The harvesting of rice can be carried out with ordinary cereal headers, fitted preferably with peg-drums to permit the operation to start as early as possible. The time of harvest is of considerable importance as a crop left standing too long dries out and loses value, its grain breaking during milling. This is due to daily variations in temperature and humidity causing small cracks to appear in the grain before it is harvested. These can be minimised by harvesting while the moisture content of the grain is still high (18 to 20 per cent.). Subsequently, the grain can be dried under uniform conditions until the moisture reaches a safe storage level.

When the crop is harvested for seed it is advisable to harvest after the moisture content drops to 12 to 14 per cent. Harvesting at a higher moisture percentage may affect seed viability.

PESTS, DISEASES AND WEEDS

Birds have damaged experimental rice crops but the extent of problems they



Harvesting the first commercial crop of rice on the Ord River pilot farm. Harvesting can be done with ordinary cereal headers, preferably fitted with peg drums

might cause on a commercial crop cannot be assessed at this stage of development. In the establishment stage, ducks and geese can inflict a great deal of damage through puddling, especially if water is allowed to remain in patches on the crop. Damage at this stage can also be caused by water coots digging out seed and young seedlings. These birds are particularly difficult to control by shooting. Also costly damage can be caused by large flocks of cockatoos on the nearly mature crop. Morning and evening shooting patrols are active at this station a month before harvest. Finches may be the most serious potential pest because they are difficult to control. Their preharvest depredations vary from year to year and are usually light in years of good rains when natural food is plentiful. Their damage can be reduced by early harvesting.

In the past, wet season rice crops have suffered from serious stem-borer damage. Of the species of this pest found in the area, *Scirpophaga innotata* (Walker) appears to be the most important. The moths lay their eggs on the leaves of the rice and after hatching the larvae bore into the stems, usually near the base. They feed inside and cause the stem to die or to produce sterile heads. As a result the extent of the damage is not fully apparent until after the crop flowers.

Stem-borer attack is confined to wet season crops. During the cool dry season, pre-pupae of the pest hibernate in the soil.

Since the 1956-57 season, stem-borer damage has been almost negligible. It is still uncertain whether this is due to control measures which have been introduced, or whether natural factors have been responsible for a general reduction in the stem-borer population. Present control measures consist of frequent dusting with 1 per cent. Endrin and early ploughing after wet season rice has been harvested to allow the soil, with its overwintering pre-pupae, to thoroughly dry out.

No serious diseases have been recorded at the station. *Helminthosporum* leaf-spots are generally present, particularly in crops suffering from either water-stress or insufficient fertiliser. However they are never sufficiently severe to cause a noticeable reduction in yield. Leaf and grain spots due to *Nigrospora oryzae* and *Curvularia* sp. have been also noted on occasions. *Entyloma oryzae* (leaf smut) has been isolated on wild rice growing in the area, but not on cultivated rice.

Weed problems have increased in recent years on the research station although an irrigation and pre-planting cultivation is commonly practised. Water grass, *Echinochloa colonum,* is the main weed. A special research programme on weed control has recently begun.

YIELDS

The highest experimental treatment yield recorded at the station is 6,920 lb. per acre and yields of over 2 tons an acre have been recorded a number of times. Bulk crops grown at the station indicate that with proper husbandry, yields of one to two tons an acre should be obtainable under commercial farming conditions, and that there is considerable scope to improve them further.

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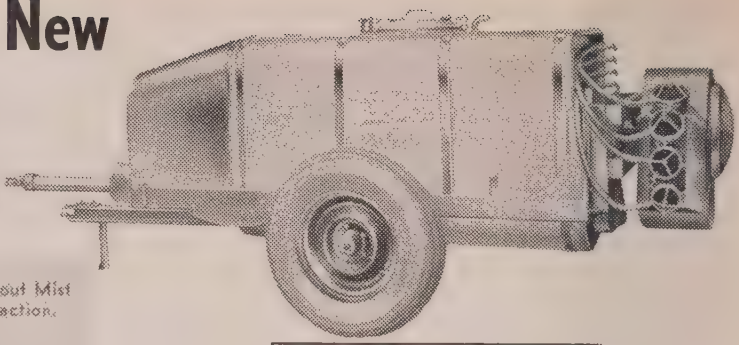

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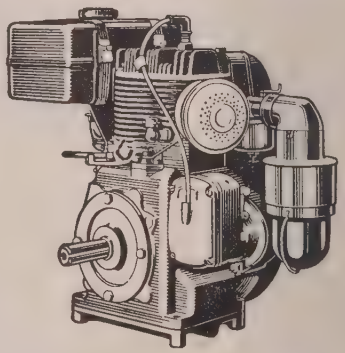

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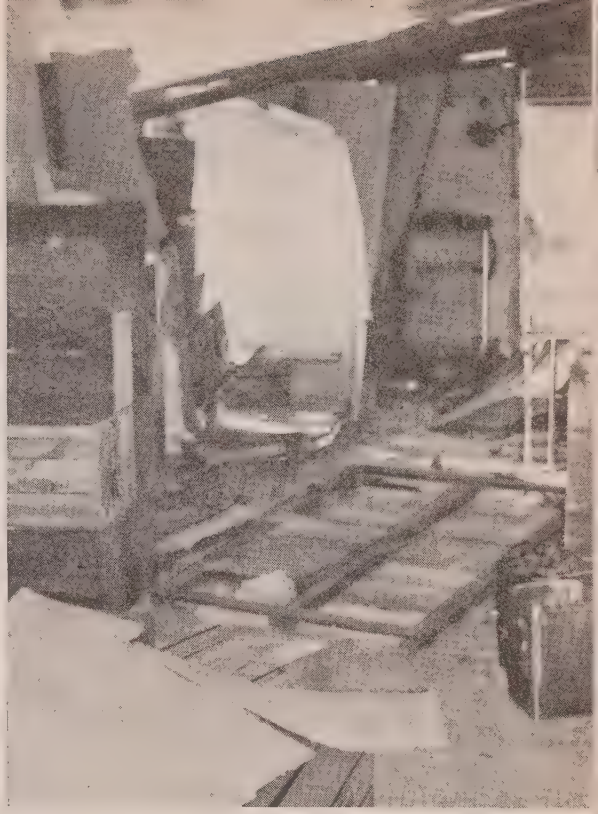
CITRUS GROWERS . . .

Don't Blow Up Your Colouring Rooms

THERE have been several dangerous incidents associated with the use of acetylene in citrus colouring chambers recently, and growers are warned to take care when using this explosive gas.

Two of these incidents involved explosions, one resulting in the destruction of the room (as shown by the accompanying photographs) and the other very nearly causing severe injury to the operator. The other occasions involved fires in a chamber.

The fault common to both of the explosions was the use of a bright element radiator in the colouring room, especially at the time of maximum gas development.



This occurs just after the carbide has been placed in the water.

It seems that although the amount of gas produced from a normal charge completely dispersed through the chamber will not constitute an explosive mixture, the localised concentration of the gas close to the generator while the reaction is proceeding could result in an explosive mixture being formed.

Obviously it is dangerous to use a heating element in a colouring room charged with acetylene, especially at charging time. It is always advisable to finish heating the room and have the element turned off before introducing the charge.

It is important too that any electrical switches or motors (such as on the fan) should be outside the chamber.

Some growers are haphazard in their use of carbide in colouring rooms, particularly in the amounts they use.

Your local Horticultural Instructor will tell you how much carbide should be used in your colouring room, and how to use it for best results—and safety.

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Honey Flora Calendar for September

COMPILED BY R. S. COLEMAN, APICULTURAL SECTION, WITH ASSISTANCE FROM THE BOTANICAL BRANCH

Common Name	Botanical Name	Where Found	Honey		Quality of Pollen	Flowering Time	Remarks
			Quality	Quantity			
Pindle or Pingli Bush	*Dryandra carduacea* Lindl.	Widespread on gravel soil	Fair to poor	Good to fair	Good	Aug.-Sept.	A good honey plant to build up bees in the Spring with some honey.
Parrot Bush	*Dryandra sessilis* (Knight) Domin. = *D. floribunda*	Widespread, seems to prefer shallow soils	Medium	Excellent	Good	Mid July-mid Oct.	It is the highest yielder of honey outside the eucalypts. Produces best in milder areas, along the coast on limestone hills.
Yellow Dryandra	*Dryandra kippistiana* Meissn.	Gravel soils in Coorow-Dandaragan area. Midland sand plain	Poor	Good ...	Good	Aug.-Oct. ...	A spindly plant, not growing very tall with pale yellow flowers. Could be the plant that produces honey tasting like silage.
Fig Flower or Couch Dryandra	*Dryandra nivea* R. Br.	Widespread	Good	Good	Good	Aug.-Sept.	Variable plant, and this means its honey producing powers might also vary from district to district.
Silky-blood flower	*Calothamnus sanguineus* Labill.	Widespread in sand plain	Poor	Good	Very good	Mainly Apl.-Sept. but actually flowers can be found all year round	Grows on rocky ridges more often than sand.
Wild Hop	*Chorilaena hirsuta* Benth.	Karri forest	Fair	Good-fair	Good	Sept.-Dec.	Bees can work it in the rain as the flowers are pendant. Associated with the Soap Bush to form the Hazel thickets of the Karri forest.
Soap Bush	*Trymalium spathulatum* (Labill.) Ostf.	Karri forest	Fair, it has a marmalade taste	Good	Good	Sept.-Dec.	Soap Bush and Wild Hop form the Hazel thickets of the Karri forest.
Diamond Bush	*Bossiaea laidlawiana* Tovey et Morris	Karri forest	Good	Good	Excellent	End of Sept.-Nov.	One of the best pollen supplies in the State. It is believed to be one of the plants which cause the bees to swarm excessively.
Taylorina	*Psoralea pinnata* Linn.	Swamps in Albany-Denmark area	Excellent white	Good	Good	Sept.-Nov.	Introduced plant.
Cape Weed	*Cryptostemma calendula* (Linn.) Druce	Widespread weed	Fair	Fair	Excellent	Late July-mid Oct.	One of the best pollen plants.
Flooded Gum	*Eucalyptus rudis* Endl.	Wetter areas along watercourses	Good	Good	Good	Mid Aug. to beginning of Nov.	Good strength building flow and if bees strong enough in the beginning will give two or more extractions.

A Calendar of Farming Operations for Cereal and Sheep Areas of Western Australia

Areas Receiving 11 in.-30 in. Annual Rainfall — 7 in.-23 in. Growing Period (May-October) Rainfall

THIS calendar of farm operations for the Cereal and Sheep areas replaces the calendar published in the December 1949 issue of the Journal of Agriculture and reprinted as a leaflet. This leaflet was subsequently reprinted twice with some amendments.

The present edition has been completely revised not only to cover more up to date recommendations, but to include recommendations for the handling of new land in the cropping section and beef cattle in the stock section. The recommendations are also designed to cover the part of the Agricultural areas lying approximately between the 11 and 30 inch isohyets, that is, the area bounded by the Southern Cross, Esperance, Mount Barker, Boyup Brook and Northampton districts.

The range of growing period (May to October) rainfall is approximately seven to 23 inches.

It is obviously not possible to include full recommendations within the compass of this calendar and references to Departmental leaflets have therefore been included so that these can be obtained for further reading. These leaflets are reprints of articles published in the Journal, and in each case the number given in brackets, e.g. (2847) refers to the number of a leaflet dealing with the particular topic. In the case of No. 2847, it is the Drenching of Sheep.

Copies of these leaflets are available free on application to the Department. Those who keep the Journal can check the month of publication of the article by reference to the list of leaflets published in the December issue each year.

MONTH	CROPPING		SHEEP AND CATTLE		PASTURES	
	OPERATION	RECOMMENDATIONS	OPERATION	RECOMMENDATIONS	OPERATION	RECOMMENDATIONS
January	Completion of harvesting	Clean, overhaul and store harvesting machinery and tractors. Order parts required. Seed grading and pickling	*Sheep*—Drench weaners	Drench weaners where necessary (2847). Sheep to stubbles best grazing for weaners. Mated ewes in store condition. Check water supplies	Grazing management. Rabbit control. Pasture seed harvesting	Stubbles can be well stocked but do not overgraze these and other paddocks as could encourage soil erosion. Poison all areas infested with rabbits (2749, 2764). Early topdressing can be carried out. Clover seed gathering in early midseason districts (2669)
			Cattle Supplementary feeding; mating	See cattle have ample feed and water (2415) supplement if necessary, particularly in-calf cows and weaners (2550, 2686, 2826). Mate for spring calving in wetter areas. Check water supplies		

February	Seed grading and pickling. Summer cultivations. Burning-off new land	If not already done, have all seed grain well graded and dry pickled with an organic mercury compound (2155). If sufficient summer rains received, plough or cultivate land for ensuing season's seeding. Check machinery required for seeding. In early districts, burning-off of newly cleared areas can be carried out as soon as declared burning season opens (2796). Check firebreaks and notify local fire authority before burning	*Sheep*—Drench weaners *Cattle*—Management ; early autumn calving	Follow up drench for weaners where necessary. Regular inspection—supplementary feeding of weaners to commence. Remove rams Ensure all cattle have adequate bulk, may need to supplement early autumn calving cows (2554). Check water supplies	Grazing management. pasture seed harvesting. Topdressing. Rabbit control	Topdress old improved pastures with 50-70 lb./ac. superphosphate ; on relatively new pastures use heavier rates, up to 1½ cwt., particularly on new land areas (2819). Check rabbit control measures, rip rabbit warrens. Clover seed gathering in mid-late districts (2669).
March	Burning-off new land. Plant "scratched-in" crops for early grazing	Complete burning-off on new land areas. "Scratched-in" crops of oats on stubble land can be seeded dry. If rain pending late in month burn off pasture paddocks intended for cropping	*Sheep* Crutching ; mules operation ; inoculation ; supplementary feeding *Cattle* — Management ; autumn calving	Crutch all sheep especially mated ewes around the udder (1091). Mules operation and tail stripping on freshly crutched ewe weaners. Tail strip wether weaners (2394). Inoculate against pulpy kidney (Enterotoxaemia) (2138). Supplementary feeding of weaners at increased rates. Pre-natal supplementary feeding of ewes to commence six weeks before lambs are due. Ensure a rising plane of nutrition (2758). Check water Same as for February. Dry cattle may need supplements also	Grazing management. Topdressing. Pasture Pasture renovation	Check paddock grazing. Complete topdressing. Re-seed pastures after cropping where necessary. Plant renovating crops in old pastures. Wimmera rye grass responds to periodical cultivation. Clean up areas intended for meadow hay. If rain pending burn off grass dominant pastures.
April	Early planting of pasture land. Cultivate fallows. Ploughing-back and early seeding of new land areas	Pasture land to be cropped without fallow should be burnt and can be ploughed (plough is better than scarifier) if, and after sufficient rain received for weed germination. Cultivate ordinary fallow areas. After rain, plough back new land fallow areas. Fire harrow where necessary. Carry out root picking ; use of root chains can be highly advantageous (2507, 2796, 2675). Plant early feed crops but delay main seeding on established areas until next month. Early seeding of new land can be carried out with later maturing varieties. First crops on new land should receive 1 bag per acre of Super-Copper-Zinc fertiliser. In some areas, ½ to 1 cwt. of Sulphate of Ammonia can be economic (2680, 2874, 2871)	*Sheep* — Drench ewe flock *Cattle* — Management ; autumn calving	Ewe flock to be drenched against worms with Phenothiazine. Continue supplementary feeding of weaners and in lamb ewes Maintain adequate quality and quantity feed to calving cows and cows with calves at foot. Supplementary feed to dry cattle	Pasture establishment	Sow new pastures as early as possible but moist seed bed preferred, particularly in drier areas (2579, 2529). Use good seed, liberal superphosphate, especially with new land, and inoculate seed, particularly on new land and where correct bacterial strain unlikely to be present. Lime pelletting of inoculated seed recommended, especially with early seeding and under dry conditions (2804). Complete March recommendations.
May	Main seeding month	Sow cereal varieties in strict order of maturity and suitability to district. With ploughed up pasture land delay seeding, if necessary, to ensure adequate weed control ; with wheat there should be an interval of about 2 weeks between initial cultivation and planting to ensure good web-worm control and diminish root rot incidence. New land should be seeded as early as possible (see April also)	*Sheep*—Lambing ; lamb marking *Cattle* — Management ; mating	Lambing ewes on good rations. Twice daily inspection of lambing flock (2777). Lamb marking (2773). Mark young in temporary yards under hygienic conditions. Cut tails level with tip of vulva in ewes and equivalent in wethers. Mules and tail-strip lambs if desired Ensure all cattle have adequate bulk. Main mating for autumn calving	Pasture establishment and management	Sow pastures as for April. Avoid over-grazing newly sown pastures—use green cereal fodder, self sown and renovating crops or hand feeding for preference. Light grazing of new pastures will retard grass competition until onset of cold weather. Follow up January rabbit control measures (2764).

A calendar of Farming Operations for Cereal and Sheep Areas of Western Australia—continued

MONTH	CROPPING		SHEEP AND CATTLE		PASTURES	
	OPERATION	RECOMMENDATIONS	OPERATION	RECOMMENDATIONS	OPERATION	RECOMMENDATIONS
June	Completing of cropping. Fallowing	In main cereal areas restrict plantings to early maturing types. Clean and store seeding machinery, order parts required. Inspect crops for non-emergence (2869, 2895) and spray for webworm control where necessary (2555, 2760). Commence fallowing—early fallow is better than late, particularly in drier areas. With new land a good ploughing with complete inversion of the sod is essential to expose soil root zone (2507, 2675, 2796)	*Sheep*—Lamb marking; supplementary feeding *Cattle*—Management	Complete lamb marking. Ewes and lambs on best pasture. Continue supplementary feeding to weaners and lactating ewes in late seasons If insufficient bulk available, continue hand feeding cattle	Pasture management ..	Rotate grazing as much as possible—fresh grazing is best for stock and also permits best pasture development. Suitable time for rabbit fumigation and warren ripping (2764).
July	Fallowing in drier areas. Land clearing and general attention to improvements	Continue fallowing as required. Inspect crop for noxious weeds (turnip and radish). Prepare for spraying and spray if necessary (2658, 2779). Early clearing of new land areas very desirable. Carry out renovations, renewals, etc., to plant and permanent improvements	*Sheep*—Preparation for shearing; pre-shearing crutching; culling prior to shearing *Cattle*—Management	Prepare shed, yards and gear for shearing (2449). Order spare parts, wool packs, hooks, branding fluid, etc. A pre-shearing "clean up" crutching is usually warranted. Cull maiden ewe flock (2645). Use scales for accurate culling on fleece weight. Mark culls for later identification. Book ram requirements Use dry cattle in particular to graze down dominant grass paddocks	Pasture management....	As for June—growth often slow this month. Towards end of month, select and close-off from stock paddocks intended for meadow hay. Roll hay paddocks with heavy roller to provide good mowing condition (2496).
August	Various	Attention to early fallowed land if weedy but use stock in preference to cultivation. Check haymaking machinery and conserved fodder requirements for coming year. Continue clearing of new land and fallowing in later districts. Order at least portion of next season's fertiliser supplies	*Sheep*—Shearing; weaning; marketing fat lambs; drenching *Cattle*—Management	Shearing (2409, 2721). Draft sheep into groups—wethers, ewes, lambs. Do not yard for more than 24 hours without feed—long periods without feed and water cause Hypocalceamia (2468). Wool brand shorn sheep with appropriate coloured siromark (2630). Wool classing. Avoid over-skirting and over-classing (2636). Use standard bale markings. Weaning—early weaning 12–14 weeks is best. Give weaners best paddocks. Drench weaners. Market fat lambs—use scales to select drafts at 60–70 lb. liveweight (2432) Use dry cattle in particular to graze down dominant grass paddocks	Pasture management....	Generally this month most pastures can be heavily grazed with frequent changes desirable. Grass dominant pasture paddocks intended to be cropped next year should receive most concentrated grazing—cattle and dry sheep useful here, but ewes and lambs should have best quality grazing. Control grass and cereal cover crop growth in newly sown clover pasture. Spring sowings of lucerne in main cereal-growing areas (2374).
September....	Attention to fallow. Hay and silage making. Land clearing. Summer fodder crops	Cultivate fallows but only when absolutely necessary (see August). Cut cereals for silage or early hay (later part of month). Cereal silage should be made at or before flowering. Cereal hay	*Sheep*—Dipping; market fat lambs	Sheep must be dipped within 6 weeks of shearing (2233). Allow 1–2 weeks for shear cuts to heal. Use approved dipping fluid according to maker's instruction. Complete dipping declaration	Pasture management. Silage making. Hay making in early districts. Pasture "topping." Fire breaks	Pasture management similar pattern as for August. Do not graze newly sown clover pastures during flowering and seed setting period. Pasture silage should be cut before full flower. Meadow

		cutting should be completed within 3 weeks for wheaten and 4 weeks for oaten after flowering. Cultivate firebreaks with due regard to soil erosion hazards (2355). Continue clearing new land. Sow summer fodder crops in frost-free areas	*Cattle*—Management ; fodder conservation	Larger quantities of hay required for cattle than sheep. Provide adequate quantities of good quality hay and silage		hay should be cut when grasses are in full flower and just prior to wilting stage for clovers. Very grassy paddocks or portions therein not required for hay should be mown and left "in situ"——providing better quality summer grazing as well as controlling grass dominance (2453, 2690). Cultivate firebreaks around pasture paddocks.
October	Haymaking. Early harvesting. Summer fodder crops	Cart hay as soon as dry enough. Baled hay can be carted sooner than sheaf. Finalise insurance of standing crops. Arrange contract grain carting. Complete firebreaks around crops. Check all grain harvesting machinery ; some early harvesting of oats may be possible but too early harvesting not desirable. Continue clearing operations if conditions right. Plough good firebreaks around areas to be fired late summer-early autumn. Main sowing summer fodder crops	*Sheep*—Shearing (late districts) *Cattle*—Spring calving ; management ; fodder conservation	Weaners should be given best grazing. Fatten cull ewes for off shears sales. Keep ewes in good store condition Arrange for good paddock grazing and ample supplies of good water for spring calving cows. Complete hay-making for cattle	Hay-making	All hay-making operations should be completed this month except possibly in the late districts. Topped pastures should be windrowed in wetter districts. Hay baling should always be done as soon as possible after cutting ; cart early rather than late for best quality hay. Avoid overgrazing wimmera rye grass paddocks to permit seed setting and especially with areas required for seed production. Harvest W.A. Lupins in early districts.
November....	Completion of hay cutting. Harvesting	"Rogue" stud seed plots for admixture and later harvest carefully to maintain purity. Complete hay carting. Plough firebreaks on new land	*Sheep*—Pre-mating inspection *Cattle*—Spring calving	Inspect ewe and ram flocks (2429) for breeding faults, bad udders, faulty testicles, etc. Clip feet. Don't dip rams in arsenic for six weeks or more before mating. Use teaser rams at 1% 14 days before fertile rams to concentrate drop (2826). Flush rams Breeder management as for October	Hay-making. Pasture management	Complete hay cutting in late districts. Control wimmera rye grass paddocks as for October. Grass seed harvesting in early districts. Harvest W.A. Lupins in later districts—other lupins in southern areas if ripe.
December....	Completion of harvest in main districts	Harvesting should be completed in all but later maturing districts. Complete grain carting as soon as possible. Some seed grading by contract carried out. Reserve extra supplies earlier maturing varieties against late opening of season. Thatch or otherwise protect all haystacks	*Sheep*—Mating	Mate in small mobs and where possible use small paddocks. Allow for plenty of shade and good water. Use 2–3% rams and if possible 3–4% for maiden ewes. Mate maidens separately—preferably a little later than the main flock	Grazing management. Pasture seed harvesting. Rabbit control	Pastures provide good grazing, stubbles also become available. Check firebreaks and fire-fighting equipment. Clover seed harvesting can commence in early districts (2669). Order pasture seed supplies (2424, 2447, 2576, 2714, 2529, 2743). Rabbit control measures during summer months (2749).
			Cattle—Management	Cut and left ("topped") pastures very suitable for all cattle, particularly cows with calves at foot. Cattle require ample good water at all times		

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ON THE DAIRY FARM

★

Seasonal Notes from the Dairying Division

★

IDENTICAL TWINS

THE response to the Department's appeal for identical twin calves has been gratifying, and so far this year five sets have been located and collected. In view of the rare occurrence of identical twinning, this indicates excellent co-operation from dairy farmers.

The twins collected this year have been placed on the Bundibup Research Station, Wokalup, and are already being used in a relatively simple calf feeding trial. As the calves mature they will be used in further highly important studies, particularly feeding, breeding, and management investigations.

Farmers are reminded that identical twins are still needed, and will be needed each year from now on. They are wanted as soon as possible after birth, preferably before they are more than a week old. Brief details of sire, dam, feeding and any other information which will help give some background to animals to be used for future research should also be given, if possible, at the time of collection.

Pictured is an attractive set of identical twins collected from Mr. H. D. Styles, of Manjimup.

GET READY FOR SILAGE MAKING

PADDOCKS for silage cutting should have been closed up by now in all dairying districts, except, perhaps, the lower south coast.

Early cutting of silage is recommended, for a variety of reasons. These include:

- It gives an aftermath of high quality regrowth, which is valuable for either green or dry grazing.
- Early cut material makes higher quality silage.
- Better pastures, with a higher clover content, will be obtained next season.

Whatever paddocks are closed up—and good pasture paddocks make the best silage—it is important that they should be clear of sticks, large stones, wire and so on, and any stumps should be clearly pegged or marked so that valuable machinery will not be damaged during the harvesting operations.

The silage making machines should be checked over before it is time to start cutting, to avoid costly breakdowns, and suitable sites for stacking, clamping or pitting the cut material should be selected. These should be well drained and easily accessible to machines or stock.

EAR TAGS TO IDENTIFY CALVES

POSITIVE identification of young calves is often a problem for the dairy farmer, especially where the calves are similar in colour and markings, or where young calves are brought in from outside the farm. It is dangerous to attempt to rely on memory for later identification.

Under the rules of artificial breeding all dairy calves got by insemination must be marked by field operators or herd recorders. The inseminator or recorder makes fairly frequent visits, but it is essential that the young calves should be accurately identified in a temporary way until he can make permanent tattoos.

A simple method of ensuring positive identification is to use coloured plastic ear tags, which are readily available in a big variety of colours. It is easy to attach an ear tag shortly after the birth of each calf so that there will be no chance of error when the tattoo is done

As well as being important to the farmer himself, correct identification is important to the success of sire surveys. A haphazard approach to calf identification introduces a risk of wrong information being used in the surveys.

IT PAYS TO BREED YOUR OWN PIGS

ONE of the most important decisions to be made by a pig raiser is whether to purchase store pigs which he will fatten for market, or to breed his own stock.

Some people like to buy stores because it is considered a speculative enterprise that may give a quick return, whilst others with small piggeries do not wish to carry the overhead expense of keeping a boar, with only two or three sows. These small farmers could possibly have their sows mated to neighbours' boars but there may be several reasons against this. For instance there is the chance of introducing disease and also the trouble of transporting the sows to the boar, possibly several times, all of which is unsatisfactory.

A seasonal increase in the feed supply, particularly with products such as skimmilk, usually creates a strong demand for weaners and slips, and these are usually expensive.

The final decision on whether or not to buy pigs may also be affected by the feeling of the grower that he lacks good facilities for breeding, or that his attempts have failed because of a high piglet mortality.

Buying store pigs may be considered economically sound in some cases, but this practice always carries certain risks.

Store pigs are largely of unknown quality. The buyer does not always know what standard of feeding or management they were subjected to before reaching the market. A farmer normally keeps his best weaners for fattening up to the porker or baconer stage, so that the store pig is commonly a cull which has been rejected because of poor growth, disease, or bad breeding.

Despite the apparent good health of pigs in the saleyard there is also a serious danger of introducing diseases, such as paratyphoid, leptosperosis or virus pneumonia.

A farmer may often lose money because he cannot purchase the class of pig which he requires, or he may be forced to pay high prices for weaners and slips, especially when there is a strong demand during the seasonal flush of skim milk.

For highest profits it is best to avoid buying pigs, and concentrate on efficient production of farm grown animals. Carry as many sows as you can over the year.

Overhead costs of keeping sows can be kept down by attention to these two fundamental points:

1. Reduce Piglet Mortality.

Good sow management, use of a recommended type of farrowing pen which will protect new-born piglets, and good control of piglets diseases should keep piglet deaths to a minimum.

2. Make the Most Efficient Possible Use of the Feed Available.

For example, to avoid wasting sows should be mated so that they farrow six weeks before 20 per cent. of the cows are due to calve. The piglets will then be ready to use the flush skim milk when it comes. If there is a surplus of skim milk, give some thought to preserving it as curd, in which form it can be stored for long periods. When little or no fresh skim milk is available in the summer, curd is useful as a feed for sows.

Grain, which often has to be carted long distances, is an expensive pig feed for dairy farmers. Potatoes are usually readily available in dairy areas, and used as a part replacement of grain, they often prove much cheaper. They are best cooked before feeding to pigs. Four pounds of potatoes will replace one pound of grain.

When it is possible to hammermill a high quality lucerne or clover hay this product can be a useful protein supplement for breeding sows, but it has the limitation of a high fibre content, and for growing pigs its use should therefore be restricted.

Green grazing is a very cheap feed for pigs over the weaner stage because it is a source of minerals, Vitamin A and protein, and if plentiful it can halve the animal protein supplement (such as meatmeal) which should normally be fed.

If at least some of these suggestions are carried out the farmer should find it more profitable to breed his own pigs.

DON'T NEGLECT THE VACUUM REGULATOR

THE relief valve or vacuum regulator is a most important component of the milking machine, as it determines the vacuum level for milking and enables full use to be made of the reserve air.

Surveys conducted by the Dairying Division have revealed that many machines are equipped with obsolete relief valves; others have been fitted with modern weighted types in accordance with departmental recommendations. The survey results have also shown that the maintenance on all types of regulators is usually very poor.

In general, the vacuum regulator appeared to be the most neglected component in the milking machines examined.

In order to obtain maximum efficiency from any type of regulator it is necessary to clean it frequently and to ensure that moving parts are free to operate. The small air admission holes should receive special attention.

In the case of spring loaded poppet types it is advisable to "grind them in" occasionally to ensure that the valve and seat faces are mated.

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FERTILISERS FOR POTATOES

In the Manjimup and Pemberton Areas

Results of four years of trials have made it possible to recommend ideal rates of fertiliser application for potatoes grown in these areas.

By J. P. FALLON, B.Sc. (Agric.), Adviser (Vegetables)

IN articles published in previous issues of the Journal each of a number of potato fertiliser trials carried out in the Manjimup and Pemberton districts has been discussed and results reported. This article briefly summarises the results of these trials carried out over the past four years and makes definite recommendations to potato growers in these districts regarding quantities of fertilisers to be used on new Red Karri loam soils.

Four potato fertiliser trials have been carried out in the Manjimup and Pemberton districts between 1956 and 1960. As discussed in previous articles, the trials involved the use of fertiliser mixtures containing various levels of nitrogen, phosphate and potash. Plantings were made on new land on growers' properties in September each year and the crops were sprinkler irrigated.

POTATO FERTILISER TRIALS

Fertiliser Treatments	Cwts./acre	First Grade Yields, Tons/acre			
		1956–57	1957–58	1958–59	1959/60
Sulphate of Ammonia	1½	11·5 ***, 13·0 **	10·1 ***, 13·9, 13·8	10·0, 12·0 ***, ...	10·1 ***, 12·4, 13·2 ***
	3				
	4				
	6	14·0			
	9	....			
Superphosphate	3	8·0 ***, 12·0 ***, 15·0 ***, ...	11·2 **, 12·9, ...	....	11·4 *, 12·1
	6				
	12				
	15			10·8 **, ...	
	18				
	20			11·0 **, ...	12·8
	24	17·0	13·3		
	25	....	....	11·3	12·3
	27	....	....	....	
	32	....	12·9	....	
Muriate of Potash	0	....	....	10·4, 11·2, 11·5 *	10·0 ***, 12·7, 13·1
	1	13·5 * 12·5	12·4, 12·2 *, 13·1		
	2	13·5			
	4	12·5		....	

The degree of statistical significance of the results is indicated by one, two or three asterisks according to whether the difference is significant, very significant or highly significant respectively.

To date only one trial has been conducted where the fertiliser ingredients have been used in split dressings. In this particular trial no benefits were obtained by two applications. However, the use of split applications of fertiliser and the possible advantages of side dressings of nitrogen will receive further attention. In this summary only trials involving the use of all fertiliser constituents as a furrow application at time of planting have been considered.

The results of each of the four trials expressed as first grade yields are summarised in the table. It is interesting to note that a similar trial planted as a winter crop at Wokalup also gave generally similar results.

It will be seen from these figures that the amounts of fertiliser ingredients for highest yields on new karri loam soils could be as high as:—

Sulphate of Ammonia—6-9 cwts. per acre.

Superphosphate—24-25 cwts. per acre.

Muriate of Potash—2-4 cwts. per acre.

However, in making a general recommendation due regard must be paid to the variations which can take place in potato crops' fertiliser requirements due to

seasonal conditions, soil differences, and frequency of irrigation.

For example, there is some evidence to suggest that as the frequency of irrigation of crops is increased, the need for sulphate of ammonia increases. This is indicated by the response to higher levels of sulphate of ammonia in 1959-60, when the trial was given more frequent watering than in previous seasons.

In the light of experience gained from these trials and from observations made on commercial crops in the Manjimup and Pemberton districts the following general recommendation is made for fertilising potatoes on new karri loam soils:—

Sulphate of Ammonia—6 cwts. per acre.

Superphosphate—22 cwts. per acre.

Muriate of Potash—2 cwts. per acre.

This is a considerable increase over the quantities of fertiliser now used by most potato growers, but in view of the price of potatoes and stability of the market, the increase in yield that may be expected from these rates should more than repay the additional fertiliser cost.

Growers wishing to use this fertiliser mixture can make special arrangements with fertiliser works to have the mixture prepared for them, but this may not be warranted as standard registered mixtures at rates which provide at least the minimum amounts of fertiliser ingredients listed could be used. Alternatively, standard fertilisers may be mixed to give the recommended quantities of ingredients. One standard registered fertiliser which closely approximates the fertiliser recommendation is Potato Manure B at the rate of 1½ tons an acre. This quantity, on average analysis, would give:—

Sulphate of Ammonia—5.2 cwts.

Superphosphate—22 cwts.

Muriate of Potash—2.64 cwts.

This fertiliser should suit most growers, particularly those who normally make supplementary applications of nitrogenous fertiliser during the growing period.

Interactions:

Results of all four trials showed that the response to each fertiliser tends to depend on the levels of the other two fertilisers applied. This means that reducing the rate of any one fertiliser below the recommended level could prevent the crop from responding fully to the other two, resulting in some wastage of these.

The recommended rate of application of each fertiliser represents the best rate to use, but only when the other two are also applied at the recommended rates.

ACKNOWLEDGMENTS

Grateful acknowledgment is made of the assistance and co-operation of those growers on whose properties trials were conducted. The considerable amount of detailed work carried out by officers of the Vegetable Section of the Department of Agriculture is also acknowledged, particularly that of Mr. T. Wachtel who was responsible for much of the work involved in carrying out most of the trials.

REFERENCES

Wachtel, T. (1957).—Jn. W.A., Dept. Agric., Vol. 6. (Third Series) No. 5, Sept.-Oct., 1957.

Wachtel, T. (1958).—Jn. W.A., Dept. Agric., Vol. 7 (Third Series) No. 5, Sept-Oct., 1958.

Wachtel, T. (1961).—Jn. W.A., Dept. Agric., Vol. 2 (Fourth Series) No. 1, Jan., 1961.

Fallon, J. P., Hardie, M. and de Haan, G. C., 1961.—Jn. W.A., Dept. Agric., Vol 2 (Fourth Series) No. 2, Feb., 1961.

DINGO AND FOX BAITS

THE Vermin Control Section of the Agriculture Protection Board has devised an effective method of preparing poison for impregnating dingo and fox baits. The method is recommended where it is not convenient to use commercial ½ grain strychnine tablets.

Directions for preparing the poison are:

Mix 1/6 oz. of methyl cellulose ("cellofas") with ½ pint of cold water, and allow to stand for 10 to 12 hours.

During this time it will swell slightly. Discard all the gel. in excess of ½ pint, and to this remaining ½ pint add 1 oz. of powdered alkaloid strychnine, mixing thoroughly.

When this has been thoroughly stirred each quarter of a cubic centimetre of the mixture will contain about half a grain of strychnine poison. This is enough to kill one fox or dingo (or wild dog.)

Using a hypodermic syringe and large bore needle the bait can be easily impregnated with this mixture.

Any poison mixture not used can be stored in an airtight jar, and should keep indefinitely. Left in contact with the air it will dry out and harden, and will not readily pass through the needle.

The advantage of this method is that it can be used to accurately measure the quantity of poison placed in each bait. This has always been one of the problems of the home manufacture of baits for dingo and fox poisoning.

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An article (with plans) on sheep yard design is being prepared for a future issue of the Journal of Agriculture.

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SHOT HOLE OF STONE FRUIT

By R. F. DOEPEL, B.Sc. (Agric.), Plant Pathologist

SHOT hole of stone fruit is a serious fungal disease which occurs in orchards throughout the fruit growing areas of the State. Successful control is based on routine applications of Bordeaux mixture at leaf fall and bud burst.

The common shot hole disease is caused by the fungus *Clasterosporium carpophilum* (Syn. *Coryneum beijerinkii*) which has been recorded on almond, apricot, cherry, nectarine, peach and plum in this State. It is most damaging on almonds and early varieties of peach and apricot which come into growth in late winter or early spring.

The emerging buds of almonds and early peaches (such as Charles Watt), may be so severely blighted that the lower parts of trees are denuded of fruiting wood.

Almonds which show pronounced gumming as a result of infection by the shot hole fungus may fail to develop normal kernels.

Certain varieties of apricot, particularly Newcastle Early, are very subject to disease attack. In the absence of control measures growers may suffer severe economic losses as a result of unsightly scabbing of the fruit.

SYMPTOMS

Affected leaves of all the stone fruit hosts show small purplish-brown markings which later enlarge into brown spots with darker margins. The invaded areas in the leaves usually become separated from healthy surrounding tissue and fall away to give the characteristic "shot hole" effect (Figs. 1 and 2).

Fig. 1.—Peach leaves and shoot affected by shot hole. Cankers have developed on the shoot during the growing season

Cankers are commonly formed on shoots of peaches and are obvious as oval sunken areas with dark brown margins (Fig. 1.)

The dormant buds of apricots are severely attacked by the fungus and present a black, shiny appearance due to gum formation. In addition the fruits are often infected and develop small purplish spots similar to those found on the leaves. Subsequently these spots enlarge and finally become raised brown areas of dry and scabby tissue (Fig. 2.)

by the adoption of systematic control measures.

The following spray schedule is recommended for routine application each year:—

At Leaf Fall in the Autumn.—Bordeaux mixture 6 : 4 : 50. This spray will also control leaf curl.

At Bud Swell in Late Winter or Early Spring.—Bordeaux mixture 6 : 4 : 50.

At Petal Fall.—Thiram at 1½ lb. per 100 gallons.

Fig. 2.—Apricot fruit and leaves showing typical shot hole symptoms. Severe scabbing has occurred on the fruit.

Infected almond fruits develop scabs on the husk and exude copious amounts of gum from these areas.

DISEASE CARRYOVER AND DEVELOPMENT

The shot hole fungus survives over the summer in infected dormant buds and in twig cankers. With the advent of autumn rains renewed fungal activity occurs on the trees. Numerous fungal seeds or spores (known as conidia) are produced and these serve to infect other twigs and dormant buds during the winter. In the spring the new growth is attacked and the typical symptoms of the disease are produced.

CONTROL MEASURES

Once established in the orchard, the shot hole disease can prove very difficult to combat, and losses can be avoided only

The following points should also be noted:

(1) A suitable spreader such as calcium caseinate should be added to the Bordeaux mixture after preparing the spray.

(2) No further applications of Bordeaux mixture should be given after bud swell owing to the risk of subsequent damage to foliage and fruit.

(3) In seasons where showery weather favours continued disease development one or two additional sprays of Thiram at fortnightly intervals after petal fall may give improved control.

Alternative Autumn Spray:

Phenyl mercury chloride at 0.1 per cent. concentration has shown considerable

promise as a leaf fall spray for shot hole control in recent trials in the Eastern States, and also under local conditions. Growers should note, however, that this treatment is more expensive than Bordeaux mixture.

BLACK SPOT OF PEAS

By the Plant Pathology Branch

ASCOCHYTA BLIGHT of peas (more commonly known as black spot or stem rot) is well known to anybody who has tried to grow peas in the winter. In the wettest months it often makes it difficult to produce a good crop of garden peas, but in summer it is unimportant.

The disease appears to be caused by a complex of three parasitic fungi—*Ascochyta pisi, A. pinodella* and *Mycosphaerella pinodes*—and although they produce slightly different symptoms their life histories are so similar that they can be considered the cause of a common disease.

Symptoms:

Are conspicuous black or purplish streaking of the lower stem and very obvious spotting of the leaves and pods. In severe cases the base of the stem may rot completely, causing the top of the plant to die.

A typically diseased plant is shown in the picture.

Spread:

Ascochyta blight is seed borne, and is usually first introduced through infected seed. Most commercial samples contain some infected seeds, which are usually shrivelled and discoloured with dark blotches. Not all show symptoms, and it is hard to entirely eliminate them by culling. Sowing infected seed gives rise to diseased plants, and the disease then spreads rapidly through the crop. Ascochyta blight may also spread through diseased crop residues in the soil, or wind-blown spores from adjacent crops.

Control:

- Sow disease-free seed from a summer crop, or carefully cull all shrivelled, discoloured or damaged seeds.
- Dust before planting with a suitable seed dressing (such as Tetroc).
- Plant on land which has not grown peas for two or three years, selecting a sunny, well drained site for winter crops.
- Support the plants well off the ground, so they will dry off quickly after rain.
- As soon as the disease is noticed spray with a Thiram-containing fungicide at 1½ lb. per 100 gals. (1 oz. per 4 gals.), taking care to thoroughly cover stem bases as well as leaves. In very damp weather, spraying at approximately weekly intervals may become necessary.

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Control of THE EMU

Vermin research officers C. D. GOODING and J. L. LONG give the latest recommendations for control of the emu, based on a series of observations and poisoning experiments in the northern wheatbelt.

IN a previous article (Gooding and Long 1959) bait media and preference, coloured materials as attractants, vehicle—food relationships during winter, use of agents to make poison adhere to grain, poisoning, regurgitation and hypnotics were discussed. This article presents additional information and the results of further experiments, and recommends poisoning techniques.

BAIT MEDIA

Although grain has been found to be the best baiting material, other substitutes have been used, particularly in the difficult poisoning periods. Split peas, together with vegetable and fruit baits, such as carrots and apples, have been tried. These were used in preference tests with wheat and were all ignored where wheat grain was consumed. Fruit and vegetable baits may have eventually been consumed had they remained attractive for a longer period.

LAYING THE BAIT

During winter, positioning of the laid free feed bait is apparently not as important as in the summer. The emus are extremely mobile during winter and quickly find bait in cropped areas and on short pasture.

During spring and in early summer, the grain is best placed on the feeding area used by the birds. This is especially so in crops and stubble where the emus may only frequent certain areas. Grain placed along a "feeding approach" is consumed

Emus eating grain laid for free feeding. Note that birds occasionally sit while eating.

so long as it is reasonably close to the feeding area.

No success has been achieved by free feeding along fence lines or close to them in the summer, and only moderate success during winter.

There is a period (varying with seasonal conditions) from August to mid-November, during which the bird's interest in laid bait becomes unpredictable or ceases. This coincides with flower formation of the natural grasses, followed by the earing of crops. As crops ripen, the emus tend to direct their feeding activity to them.

Although interest in grain bait has been established following the above (August-November) period, a successful poisoning campaign remains to be accomplished during summer.

In 1958-59, it was found that it was possible to park a vehicle in the middle of a paddock and to watch the birds feeding at close quarters. This relationship was re-established in the winter of 1959-60, but was found to be more precarious and removal of the observer from the paddock resulted in extra consumption of grain. With an observer in the paddocks, birds consumed an average of ¾ lb. of grain per head, but a further 1½ lb. per head was consumed after he retired. It was thought that the lowered consumption caused by the presence of the observer may have resulted in some of the regurgitation due to the ingestion of sub-lethal doses of poison, which had been noticed in previous years.

POISONING TESTS

Phosphorus:

Phosphorus in the form of "Grim" Rabbit poison was used with no success. Emus were free fed three times before the introduction of the "Grim" but refused to eat when the phosphorus was added. (1 lb. of "Grim" mixed with ½ pint of water and placed on 20 lb. of wheat grain, was used.)

Arsenic Capsules:

It has been found that the emus will consume gelatin capsules sizes No. 5, 4 and 3 when placed in heaps of wheat. If they are coloured yellow-brown the consumption is increased. However, when arsenic trioxide was added to these capsules, regurgitation occurred. It is probable that the slow break down of the capsules and therefore slow leakage of poison made the birds feel sick and caused regurgitation before a lethal quantity could be assimilated.

CONSUMPTION OF CAPSULES

Uncoloured Capsules (Two Tests)—

Size No. 3	No. laid 25	No. consumed 17.
Size No. 3	No. laid 25	No. consumed 18.

Yellow Brown Capsules—

Size No. 4	No. laid 25	No. consumed 25.
Size No. 5	No. laid 25	No. consumed 25.
Size No. 3	No. laid 25	No. consumed 25.

Arsenic Trioxide Filled Capsules (Two Tests)—

Size No. 3	No. laid 50	No. consumed 8.
Size No. 3	No. laid 25	No. consumed 7.

POISONING WITH STRYCHNINE

Numerous trials have shown strychnine to be the poison with the greatest potential as an emu killer, and therefore most of the work has aimed at developing a field technique with this poison.

(a) **Poisoning Periods:**

Winter, generally from May to July, has been found the best time to poison emus in the northern wheatbelt. Natural grasses start heading about August, followed by the crops themselves. During this period, emus are very difficult to poison. Once crops have been harvested, interest in grain bait can again be established while the birds are feeding in stubble areas. However, only one successful poisoning (100 per cent. kill) has been achieved in this period, and further work is still required.

From January to March, water poisoning has been found to be reasonably successful, but further work is required to ascertain the optimum poison rates and other factors in water poisoning.

(b) **Free Feeding:**

Free feeding is important to ensure that all birds in an area have found, and become accustomed to feeding from, laid grain stations. These are established by placing out wheat grain where the birds are seen to feed or congregate regularly in a paddock.

Small heaps of five to ten pounds of wheat are sufficient if spaced at intervals across the area chosen for the poisoning. It sometimes happens that birds do not

find the grain for two or three days and patience may be necessary to free feed successfully. If no success is achieved within a week, the heaps should be laid in another location.

Once the birds have eaten from the heaps the amount of grain laid should be increased to at least 2 lb. per bird during the free feeding period. Experiments have shown that emus may consume up to 3 lb. of grain per bird.

After the initial free feed, paraffin oil at the rate of four fluid ozs. per 10 lb. of grain should be added to the wheat. This is the best agent for adhering poison to the grain.

One day should be left between each free feed and the bait should be laid towards evening so that the birds are disturbed as little as possible. Three free feeds are sufficient during winter, but at least six should be given in the period after harvesting. There is definite merit in increasing the amount of paraffin and decreasing the amount of grain laid on the sixth (last) free feed in summer months. The different procedure for summer and winter poisoning is shown as follows:—

TYPICAL WINTER POISONING

Population 27 Emus.

	Grain Laid	Consumed	Paraffin Oil Rate
1st day free feed	36 lb.	....	....
2nd day	....	36 lb.	....
3rd day free feed	36 lb.	..	4 oz./10lb.
4th day	....	36 lb.	..
5th day free feed	36 lb.	..	4 oz./10lb.
6th day	....	36 lb.	..
7th day Poison	20 lb.	19 lb.	4 oz./10 lb

Kill 100 per cent. Deaths 27 emus.

PATTERN FOR SUMMER POISONING

Population 41 Emus.

	Grain Laid	Consumed	Per cent. Eaten	Paraffin Oil Rate
1st day free feed	40 lb.		...	....
2nd day		16 lb.	40	....
3rd day free feed	72 lb.	..	....	....
4th day		58 lb.	80	....
5th day free feed	82 lb.	..	....	4 oz./10 lb.
6th day		82 lb.	100	..
7th day free feed	100 lb.	..	....	4 oz./10 lb.
8th day		100 lb.	100	..
9th day free feed	128 lb.	..	....	4 oz./10 lb.
10th day		128 lb.	100	..
11th day free feed	64 lb.	..	....	8 oz./10 lb.
12th day		64 lb.	100	..
13th day poison	32 lb.	..	...	4 oz./10 lb.
14th day	....	21 lb.	65	....

Kill 100 per cent. Deaths 41 Emus.

(c) **Poisoning the Grain:**

Amounts of strychnine up to 2 ozs. per 10 lb. of grain have been used, but 1 oz. of strychnine per 10 lb. of wheat has been found satisfactory. It is recommended to use a soluble form of strychnine. This should be mixed with 4 ozs. of paraffin oil and the mixture applied to the grain. One half pound of the poisoned grain per bird is ample for most poisonings.

Soluble strychnine is obtainable as the hydrochloride, bisulphate or nitrate.

(d) **Amount of Poisoned Grain Consumed:**

One test was conducted to ascertain the amount of poisoned grain consumed by individual birds. The grain was removed from the stomach and weighed and the amount of poison consumed by individual birds was calculated.

A variation from 2.9 to 12.1 milligrams per pound of body weight was found with nine birds. The total amounts of grain consumed ranged from 1 oz. to 6½ ozs. per bird.

CONSUMPTION OF POISONED GRAIN

No.	Weight of Bird	Poisoned Grain Consumed	Poison Consumed
	lb.	grams	mgm./lb.
1	84	81·0	6·2
2	84	113·3	8·3
3	72	126·2	10·9
4	55	102·9	7·9
5	69	189·1	12·1
6	61	27·5	2·9
7	51	50·3	5·0
8	84	71·1	5·3
9	60	46·5	4·5
Average	69	80·8	6·9

Variation 2·9 mg./lb. to 12·1 mg./lb.

It is assumed that at a rate of 1 oz. strychnine on 10 lb. of grain, an ounce of poisoned grain is enough to kill most birds.

(e) **Future Work:**

Future work will be directed towards improving the field technique of the summer poisoning method. It is thought at present that the free feeding period may be shortened if the method employed on the sixth free feed advocated above is adopted, that is, increasing the paraffin oil and decreasing the amount of grain laid. This is suggested by the results of the experiments so far conducted.

Emus feeding under observation. Birds will feed when watched, but consumption is reduced.

WATER POISONING

Investigations into the water poisoning of emus are still in the initial stages. From the work carried out to date, it seems that there is no easy method. It has been found difficult to interests more than a few birds of a large flock in strange watering places, such as drums and troughs buried in the ground where they are feeding. The most obvious solution is offered at regular watering places such as mills, but watering stock then becomes a problem.

Indications based on the water consumption of birds on the observation area reveal that an emu will drink between 2.7 and 5.0 pints of water a day. A poisoning conducted at Geraldton in January, 1960, using 2 ozs. of strychnine to 25 gallons of water, produced a kill of 50 per cent. of the population of birds in the area. A 44 gallon drum split lengthways was buried in the centre of a stubble paddock where birds congregated. Free water (non-poisoned) was available for ten days before the poison was introduced.

EFFECT OF POISONING OVER A THREE YEAR PERIOD

Poisoning work has been conducted on one property in the northern wheatbelt throughout the three years of experimental work. During this time, the population has been reduced to negligible proportions. Counts made at the end of 1958 showed there was a population of up to 139 birds visiting this property. Taking into consideration the increase in the next two years, plus the number of birds killed, the figure reached is five birds still surviving. (See Appendix Table I). The final average count in January, 1961, was also five (figures of 5, 6, and 4 respectively). This would indicate that continued poisoning over a period will eventually reduce the number of birds in an area, provided there is no annual build up of the resident population by migratory birds.

FENCING AND CLEARING

Good boundary fences and cleared paddocks offer the best long term control programme on the farm.

The emu problem has already been pushed back into the less settled areas of the State, the material factor being man and his settlement of the country. For those farmers in the sparsely settled districts and those bordering virgin land, there is no better control than a vermin proof fence and clearing areas which are potential harbour for vermin.

There are probably many types of fencing suitable to withstand the strain imposed by emus, provided they are not deliberately chased into it. A normal rabbit netting fence is reasonably efficient under these conditions. However, it is probably desirable to erect a somewhat stronger fence if the birds are troublesome. The Agriculture Protection Board has already

erected an Emu Barrier Fence between the Nos. 1 and 2 Vermin Fences which has withstood the birds to date. This fence may be beyond the pocket of the average farmer, but can serve as a useful guide to those who contemplate building a fence for similar purposes.

In Geraldton, where these investigations have been carried out, the owner of the property has already enclosed some 12 miles of his boundary with a suitable fence which has proved adequate so far. It is 4 ft. 6 in high, and has posts spaced 48 ft. apart with steel droppers between them. This gives the fence resilience when birds make contact at speed and tends to throw them away from it. Wiring is 3 ft. of rabbit netting from ground level, with 3 barb wires above. On either side of the fence a large cleared space has been left with the intention of causing the birds to run parallel with the barrier instead of into it.

With all barrier fences against emus, it is a good idea to round off corners, where emus usually congregate.

OTHER METHODS OF CONTROL

Other methods such as frightening devices, flags and shooting offer some solution to the emu problem in areas where they could be used effectively.

Devices such as acetylene guns which produce a loud "bang" at regular intervals have been used with some success over relatively short periods. However, as has been found in large areas of crop, the birds will soon become somewhat accustomed to these, and they are not recommended in the outer wheatbelt.

Shooting if carried out effectively, is helpful in some areas but can cause increased damage to crops if the birds are merely frightened from the paddock and allowed to return later each day. Usually, the agility of the emus and the habitat in which they live make effective shooting very difficult unless the farmer is fortunate enough to have a barrier fence along which the birds can be chased and shot with comparative ease. This usually results in damage to the fence.

If shooting is carried out, it is useless to attempt to poison emus. The birds must be left alone and allowed to continue about the property in their normal manner.

ACKNOWLEDGMENT

Acknowledgment is made of the invaluable assistance rendered by Mr. "Mick" Forrester, of Wicka, via Geraldton, on whose property the work was carried out.

REFERENCES

Long, J. L., 1959.—Some notes on the Emu in the Northern Wheatbelt of Western Australia. The Emu Vol. 59, pp. 275-286, 1959.

Gooding, C. D., and Long, J. L., 1959.—Preliminary Investigations into the control of the Emu in the Northern Wheatbelt of W.A., Journ. Agric. W.A., Vol. 8, No. 6.

APPENDIX

TABLE I

THREE YEAR POISONING RESULTS

Year	Based on highest adult figure in year	Based on highest chicken count	Based on count figures	Actual poisoning figures	Kill for Year	No. Birds Left
	Adult Population	Chicks Increase	Total Population	Deaths		
					%	
1958	111	43	154	15	9·5	139
1959	92	42	134	86	64	48
1960	92	29	117	119	100	0
1961	6*		...	...	...	
Total	....	....	....	220		

Calculated Residual Population from Observation Data

No. birds left 1958	139
+ 1959 chick increase	42
1959 population	181
Less 1959 deaths	86
1960 population	95
+ 1960 chick increase	29
	124
Less 1960 deaths	119
Present population January, 1961	5

* = January observations only.

Starting with the calculated population left in the area in December, 1958 (139) the observed chick increases have been added and the deaths substracted each

year until an estimated residual population of five birds should have been in the area in 1961. Only one series of counts has been made in 1961, and these agree with the estimated residual population.

These observations and calculations support the theory that, at least in this area, there has been practically no migration of birds into or out of the area, other than of a temporary nature. It would seem that the emus in this area may range over large feeding and breeding areas but in the seasons under review, have not left the area in large numbers; nor has there been any appreciable increase in the number of new residents in that time.

RABBIT "KILLER" SCHEMES IN ENGLAND

IT was only during the last war when food production was at a premium that really serious consideration was given to rabbit control measures in England. When myxomatosis spread a few years ago, the great improvement in crops and stock carrying capacity showed the tremendous losses rabbits had been causing.

The Infestation Control Section of the British Ministry of Agriculture, Fisheries and Food has been concerned over the problem and one of its senior officers, Mr. Harry V. Thompson, who is recognised as one of the world's leading authorities on vermin control, visited Australia and other countries three years ago, to see what was happening here. After a close and painstaking study, which must have shown clearly how other methods have failed, he reached the understandable conclusion that the killer method held the only solution. However, its application to British agricultural practices, organisational and supervising systems and destruction methods, presented some problems. Firstly, poison may not be used. Fumigation, warren destruction and cover removal are the main destruction measures. Secondly, the general structure and organisation of agriculture is on a different basis from Australia's and New Zealand's.

The system finally decided upon was small voluntary Rabbit Clearance Societies, which employed men to destroy rabbits on the properties of subscribing members who were bound together by legal agreements and contracts. Over 500 societies have been formed in 2½ years. In an article entitled "Getting Rid of the Rabbit," by H. V. Thompson, which appeared in the 1961 issue of "Co-operative," the official journal of the British Agricultural Control Co-operative Association, information is given on the progress which the societies have made.

The area of a society would depend on local conditions, the size of farms and the type of farming, not to mention the type of farmer. Most are about 9,000 to 10,000 acres, but they range from 4,000 to 20,000 each employing at least one full time operator. Some of the societies are amalgamating and one already covers an area which included six societies previously. With the trend in this direction, a general coverage will be reached soon. County conferences are already being held and a National Federation has been formed, so that it is likely that eventually the scheme will be controlled by one central organisation acting through the local societies.

About 650 full time men are employed and in many cases, there is considerable competition for the positions. In addition, some societies employ contractors.

Myxomatosis is mentioned as now being spasmodic and unpredictable in its action. Killing effectiveness ranges from 10 per cent. to almost 100 per cent. Over half the country, the effect is so variable that it can be regarded as only an occasional ally; in about a quarter, it is still a most important factor in control, and over the other quarter it has little effect.

One statement was that as long as there is a trade in rabbit skins and carcasses, there will be a vested interest in rabbit preservation, and another was that "it cannot be stated too often that unless the profit motive is removed, the clearance of rabbits is impossible"!

The Government contributes towards the scheme and it is estimated that when the societies have a total coverage over all the agricultural, woodland and common land, the total overall cost to the societies and the Government will be about three quarters of a million pounds a year.

I think that although this modification of the New Zealand scheme would hardly be applicable to Australian conditions, it is a remarkable illustration of the use of the "Killer" principle. With other modifications to suit our practices, the principle is one which we in Australia should adopt as soon as possible. It is the only way rabbits can be effectively controlled and even eradicated in many places.

(By A. R. Tomlinson, Chief Vermin Control Officer, in an A.B.C. broadcast.)

COPPER MINERALS FOR FERTILIZER USE

R. N. GLENCROSS, B.Sc., (Agric.),
Research Officer, Plant Research Division

COPPER fertilizers have an important role in maintaining and increasing Western Australia's agricultural production. On many soils they are essential for cereal growing or pasture production and persistence and for animal health and wool quality. They are also sometimes used for fruit trees, vines, and vegetables.

The most efficient and economic way to provide the essential copper has been to use a copperised fertiliser.

Up to 1947 most of the copper used in fertiliser was bluestone or purified copper sulphate, but because copper is required by plants and animals in minute traces copper materials less soluble in water can be equally as effective. These materials occur naturally in rocks as various copper minerals, mixtures of which are called copper ores. In this State we are fortunate in having several extensive deposits of copper minerals particularly at Marble Bar, Meekatharra and Ravensthorpe.

Copper deposits are generally in the form of a primary mineral, chalcoyprite, a copper iron sulphide compound. From this other copper minerals (copper oxide and carbonates) are formed naturally, and constitute a surface oxidised copper zone. When this oxide and carbonate material is ground to a suitable fineness it becomes readily soluble and is equal to bluestone in providing copper for plants. This material, known as ground copper ore, has been used in Western Australia for copper fertilisers for about 15 years.

In between this surface weathered or oxidised zone and the lower unweathered sulphide zone is an intermediate body of complex sulphide and iron copper minerals such as bornite and copper glance. These have slight solubility and lower availability to plants.

Unfortunately, the oxidised zone of copper minerals has a limited life and will eventually be exhausted. To obtain copper for fertilisers we must either revert to using the expensive purified bluestone or endeavour to make the sulphide minerals more available to plants. It is along the latter line that we are experimenting.

Copper sulphide minerals can be made to become soluble and an effective source of copper for plants—but this must be kept within the realms of economics and practicability.

Insoluble copper sulphides can be made more effective by grinding to extreme fineness or by heating to moderate temperatures. Grinding exposes much more surface, which helps soil and atmospheric agents convert the copper to soluble forms, whereas by heating, more soluble forms are produced artificially.

Experimental work with various sources of copper has been carried out since 1940. It was shown that roasted residues containing 2.5 per cent. copper, mainly as oxide and sulphide, and a pyritic ash with one per cent. copper gave the same improvement in pasture regeneration as copper sulphate. However, this was neither economical nor practical.

Subsequently, other sources were examined, mainly roasted and crushed sulphide ores. The general conclusion was that sulphide sources were inferior for cereal production but did provide some useful copper.

Today the copper position is more critical and conclusive evidence is required. Previous and present trials have shown that less soluble sulphide mineral materials do provide copper slowly and improve with time. But how are we to speed up this solubility and availability?

Tests are now under way on the possibilities of achieving this by finer grinding to make sulphides more rapidly soluble, by roasting to convert part of the minerals to soluble forms or by mixing the more soluble forms with the sulphide sources. Wheat and subterranean clover are the test plants. With this information the copper situation will be much more certain than it is at present.

Modern Chemicals and the Control of Insect Pests on Livestock

By C. F. H. JENKINS, M.A., Government Entomologist

INSECT PESTS have taken toll of man's flocks and herds since very early times. Even now they levy a larger and more consistent tax than the most voracious Commonwealth Department.

How is it that such small and apparently defenceless creatures are able to persist and even thrive, despite the rapid development of modern insecticides? The answer is, of course, that although many insects and allied creatures are small and delicate in structure, they possess some of the most remarkable adaptations for survival to be found anywhere in nature.

Insect damage to animals is usually much more difficult to measure than damage to plants. For instance, it is difficult for the layman, and even for livestock specialists for that matter, to perceive weight losses or gains of say 50 lb.; variations of a lesser amount, although important, may go quite unnoticed.

It is well known however, that the activities of ticks, lice and flies may seriously affect the condition of all types of livestock, quite independently of any diseases which may also be involved. In the U.S.A. alone, direct insect attacks on livestock are estimated to cause a loss of at least £300 million a year. No comparable estimate is available for Australia, but the blowfly alone costs our wool growers millions of pounds a year, and the cattle tick and the buffalo fly are a comparable drain on the beef industry.

For many years arsenic, rotenone and pyrethrum were the staple dips and sprays for use against stock pests. In many instances they gave useful control but offered little promise of complete eradication.

The first real prospect of a major break through came with the development of DDT and B.H.C. These materials gave almost miraculous results against ticks, lice and flies and seemed to offer new hope in the war against insects. But optimism was not well founded, for these earlier materials became less and less efficient, despite repeated increases in the concentrations used.

The ability of certain insects to develop resistance to toxic chemicals has been known for many years. In the early nineteen hundreds certain scale insects were known to be able to resist cyanide fumigation, and some caterpillars and ticks had shown an ability to defy treatments with arsenic. The recent trend is much more rapid, and offers a serious challenge both to the chemist and the entomologist. The rapid development of new chemicals has offered a partial solution and at least ensures a breathing space while more fundamental aspects of the problem are explored.

But it is disturbing to note that once having developed resistance, say to DDT, an insect may also be resistant to other chlorinated hydrocarbons such as B.H.C., Dieldrin and Chlordane, or at least have a flying start in acquiring such resistance.

A completely new group of insecticides known as the organic phosphates, and containing parathion, malathion and diazinon, has stabilised the position for a time, but some resistance to these materials has already shown up and must inevitably increase.

The use of systemic insecticides has given good results against sap sucking insects of plants for several years, but progress against blood sucking pests has been disappointingly slow.

Such a method is, of course, subject to severe limitations. These are:

- The material used must be relatively harmless to the animal being treated.
- It must accumulate in the blood stream in sufficient quantities to kill blood sucking parasites.
- It must not accumulate in the milk or body tissues of animals later required for human food.

Promising control of the cattle grub or ox warble fly of America has been achieved with systemic sprays, but this is of little interest to Australian cattle men as the pest is unknown in this country.

Work is continuing in the hope that this method may yet be applied to lice, ticks and even blowfly maggots, but the difficulties are many and no immediate success seems likely.

Another line of attack which has been intensified in recent years, and with some promise of success, is the use of insect repellents. Stable flies and march flies are quite annoying to stock even in the South-West, but their activities are negligible compared with the visitations of the buffalo fly, the horn fly and other tropical species. Several of the repellents so far tested are quite expensive, and in all cases the period of relief is quite short. The method has distinct possibilities however, particularly for dairy stock. It is one which may become much more important in the not-too-distant future.

FALLOWING NEW LAND

By H. G. CARISS, B.Sc. (Agric.),
Adviser, Wheat and Sheep Division

The key to rapid development of new land and early establishment of a good pasture is the efficiency with which all clearing and cultural (including seeding) operations are carried out.

Each operation is dependent on the preceding ones.

With the development of virgin country the initial clearing must be done in such a way that the minimum of vegetation is left for the plough to handle to prepare a good seed bed.

A sound procedure must be followed. The one recommended by the Department of Agriculture, is briefly this:

- Roll, log or chain the area, preferably during winter and spring to allow as long a drying out period as possible.
- Burn the following autumn.
- Carry out the initial ploughing in the winter and spring, again, as early as possible.
- A second ploughing should be given the next autumn, after the first rains.
- Seed in late April to June, depending on the season.

Many people who have heard Departmental officers stressing the need for fallowing ask:

> Why must I fallow? Can't I plough up as soon as possible after the burn and put my crop in a year earlier, so saving myself a long and possibly expensive wait for my first return?

Others say:

> Why all this burning and rolling? Why not put the plough straight in, then plough back and fire harrow the following autumn and save a year?

Some success has been achieved with both alternatives but the longer method is still the best. It is important to realise that the delay only occurs with the first unit of a block being developed. Often this is no hardship or disadvantage, certainly not when weighed against the long term benefits of the recommended method.

Why do we advocate fallow?

The key to success on new light land: A clean fallow on well prepared land.

Research and experience on a broadacre basis has clearly shown that ploughing and inverting the sod to expose the underlayer to the action of the elements assists the breakdown of the plant residues. This gives a better seed bed for crops, and for pastures, not only a good seed bed but reduction or even elimination of the seedling mortality of legumes which often seriously affects the speed of development of a good pasture.

Depth of ploughing is not as important as the complete cutting off and turning over of the sod. Ploughing too deep could be a disadvantage, and about five inches is suggested as most suitable.

The second ploughing, which is advocated for the autumn and should be done under moist soil conditions, is still a part (and a vital one) of the fallowing operation. It enables the rough surface from the original ploughing to be broken down and, most important, the seed bed consolidated. This eliminates air pockets, providing good conditions for the actual seeding operation later.

If seed bed preparation is poor low yields can be anticipated. The resulting loss is likely to be more expensive than the cost of good cultivation.

Short-cut, or so-called "cheap" methods of land preparation can be very costly.

THE STATE HERBARIUM AND THE FARMER

By R. D. ROYCE, Officer in Charge, Botany Branch

A MUSEUM is an institution which is well known to the great majority of citizens. Its purpose is to accumulate, house and provide the means for studying all types of specimens of historic or scientific importance.

An institution which collects, houses and studies plant specimens exclusively is an Herbarium, and in the State Herbarium of Western Australia we have just such an institution. It is controlled by the Department of Agriculture, and forms part of the Botany Branch.

The flora of W.A., with which the State Herbarium is primarily concerned, consists of some 7,000 species, mostly native to the State, but containing also many species from other lands which are now firmly established here as naturalised aliens. The identification of these is the principal work of the botanists on the herbarium staff. When the large number of plants cultivated in gardens is added to the total it will be seen it is no mean task to keep track of all these plants.

One may ask why is it so important to name plants.

Many species have what are called "common names" and most people would prefer to use them. This would be very nice if everyone would use the same name, but unfortunately this does not happen.

For instance, "bloom poison" is a name used by farmers in many districts, but usually it refers to a different plant in each district, and some are not even toxic. Similarly "kerosene bush" is a name applied to any plant which burns with a black smoke, while "fire bush" is used for any one of half a dozen species which regenerate rapidly after fire. Again the plant known scientifically as *Verbena bonariensis* is widely known as wild verhena, but in Victoria it is called cluster-leaved vervain, in New Zealand and Queensland it is known as purple top, and in Western Australia as wild sage.

To overcome this difficulty botanists throughout the world have agreed that every plant shall have a scientific name, that this name shall be formed according to a definite set of rules, it shall be latinised, and it shall be universally applied. In this way no two plants can be confused, and the name of each can just as readily be understood by an Australian botanist as by a German or a French botanist.

The importance of this universal nature of plant names is evident when dealing with introduced species.

Whenever a new plant is recorded as naturalised, the first step is to identify it, that is to determine its correct botanical name. This is a most important step because as soon as it has been named, the whole store of the world's knowledge concerning this plant can be tapped. By searching the literature, one can find out where the plant grows, whether it is useful or not, and what other people have discovered about it. In other words the whole of the world's experience can be drawn upon, not only of the present but also from the time the plant was first discovered and given a name.

If the plant were incorrectly named the wrong information would be obtained. The work of the botanists attached to the Herbarium is therefore of the utmost importance, and it is indeed the foundation on which many other botanical processes rest, particularly that of weed control.

Many examples of this could be quoted. Some eight years ago a specimen of an unusual weed was sent in to the Herbarium by an officer stationed at Bunbury. This plant was identified as *Alternanthera pungens*, or khaki weed, a species which had for many years been listed as a noxious weed for the State. Reference to the weed literature showed that it had proved a particularly objectionable weed in other countries, and immediate steps were therefore taken to destroy the plants in Bunbury, before they had a chance to spread.

In 1948, specimens of two plants were received from a property in the Walpole district. One was identified as *Senecio jacobaea*, the Ragwort, a plant which was known as a serious weed of pastures, while the other was found to be *Cirsium arvense*, the Canada Thistle, and one of the worst of this aggressive and objectionable group of weeds. The seriousness of these weeds in other countries was well documented, and within a week the plants had been sprayed with a weedkiller in the first operation of an eradication programme.

These instances demonstrate the significance of the work carried out by the botanists. It is also vital that help should be received in the form of specimens. Every time a strange plant is found in the paddock or anywhere in the district it should be forwarded for identification. It may be a very common plant, but again it may be the first record of a very serious weed.

Only by the identification of the plant, can it be placed in its proper category of just a native plant, a fodder plant, a weed or a poisonous plant.

In Western Australia this category of poisonous plants is a very important one. In the native flora there is a great array of pea flowered plants which are highly toxic. The first of these was identified as poisonous in 1839 by feeding trials with goats carried out in the Williams district, and in 1864 in Vol. II of his Flora Australiensis Bentham listed several toxic species including box, rock, York road, and heart leaved poisons. In the course of agricultural expansion in the State many other species from a wide range of plant families have been identified, and many have been brought to notice during the routine investigations of stock losses.

When these deaths occur, and the veterinary services are unable to demonstrate any specific disease, a botanist is frequently called in to assist. In the search for evidence of poisonous shrubs, examinations are frequently made of the stomach contents of the dead animals, where there is usually enough recognisable leaf material to give a useful clue to the plant species on which the stock had been grazing. Botanical surveys may also be carried out in the paddocks in which the animals had been running in the hope of finding suspected poisonous plants which the stock had been eating.

The work of botanists in many parts of the world has helped materially in solving a number of puzzling stock diseases. In America, South Africa, Europe and Australia botanists have achieved success in this field, while in Western Australia a botanist of the State Herbarium was a prominent member of the team which succeeded in identifying the cause of the Kimberley Horse Disease, a malady which had for many years caused serious losses amongst the horses on many Kimberley stations.

In 1934 a research team consisting of a botanist and a veterinary pathologist from the Department of Agriculture carried out a survey of the toxic species of the State. Plant material was collected from many districts and was used in feeding trials with sheep at the Avondale Research Station. As a result of this survey a comprehensive list of the toxic native leguminous shrubs of the State was made, and knowledge of each of the many species was greatly increased. In the last few months another research committee has been set up within the Department, again including botanists and veterinarians, to continue and greatly expand the work commenced in 1934.

These are but a few of the activities in which the officers of the State Herbarium play their part. The routine activities consist of the maintenance of the Herbarium collection of plant specimens which at present numbers some 63,000 sheets, and the identification of specimens of plants sent in for comment by farmers, beekeepers, naturalists, and many others including officers of Government Departments whose work involves plant life. Enquiries are received regarding weeds and fodder plants, as well as trees and shrubs for shade and shelter belts, and for the home garden, while very many enquiries are received regarding supposed toxic plants.

On these questions and in many other ways the botanist can assist farmers and the general public. But to be of greatest help in giving advice on plants the botanist himself needs help in the shape of specimens. Without good material, plants cannot be named accurately.

As a concluding thought I would like to suggest that if you find a strange plant on your property or in your district, collect a specimen and send it in for identification. It may be important both to you and your neighbours.

KEEP YOUR JOURNALS

HERE at the production end, we are sparing neither expense nor effort in making the "Journal of Agriculture" a publication which will help you in your farming operations.

We suggest that the Journal is worth keeping and that a year's issue will make an attractive and useful volume for your library—a volume that is full of sound factual information, attractively presented.

Arrangements have been made for the compilation of a comprehensive index to be incorporated in the December issue—a feature which will greatly enhance the value of the Journal as a work of reference.

Show Exhibits

By HELEN M. GLOSTER

THE annual round of country agricultural shows will soon be with us.

Who, among the readers of "Farm and Home" have ever considered becoming exhibitors? Probably very few. But there is always a first time for embarking on a new venture, so why not take an active part in your next local Show by becoming an exhibitor, and making at least one contribution to the success of this important event?

The aim of an exhibitor should not be merely to beat all rivals at a particular skill. This should be incidental. Your main purpose in exhibiting should be to play a part in making your local Show an unqualified success. However, by keen competition participants are encouraged to develop and improve their techniques in various skills.

NEEDLEWORK

Fancy Work and Handwork:

With the increasing pace of modern life the skills required for hand embroidery, fancy work and handcrafts generally are in danger of becoming lost arts. With the coming of television and more varied interests there is less time available for hand work.

Each new model in sewing machines brings forth yet another new gadget for doing with the machine what was once done by hand, and while machine embroidery is undoubtedly a good substitute, it will never equal the beauty and perfection of good handwork.

Handwork which is up to exhibition standard should be a combination of neatness, cleanliness, accuracy and above all, artistry.

First impressions are very important, so see that all your exhibits are presented as attractively as possible. They should all be *spotlessly clean* and *well pressed* with that "untouched" look so evident in the better type of bought merchandise.

If you consider your handwork would be improved with laundering it is not up to exhibition standard. A skilful needlewoman keeps her work spotlessly clean.

An exhibit which requires folding should be folded very carefully so that embroidery shows to the best advantage. It should then be placed in an open cardboard box, covered with cellophane and if desired, finished off with a bow of ribbon.

Small exhibits—doyleys, tray-cloths, table centres and similar articles—may be mounted on coloured paste-board or on white paste-board with a layer of coloured tissue paper under the embroidery to show

it off to better advantage. There are no set rules for background colour. However orange and tomato shades are recommended as good colours for showing up white work to advantage.

When attaching small exhibits to paste board, leave the lower edges free so that the wrong side of the work may be examined easily.

Handkerchiefs may be folded into fancy folds with embroidered corners uppermost then mounted or boxed. A single handkerchief may be mounted on a Christmas or birthday card if so desired.

Always read the directions in the Show schedule very carefully and carry out the instructions to the letter. Many an exhibitor has been disqualified through not paying sufficient attention to the rules as laid down by the Committee.

In the embroidery sections aim at a *good variety* of stitches. See that the stitches you select are suitable both to the material and to the design, and conform with instructions given.

Most women buy doyleys, suppercloths and similar articles with the design stamped on in readiness for working. If possible, it is a good idea to make up your own designs or select unusual and attractive designs and put them on yourself. In this way you may produce superior work or at least work which shows individuality and originality and should help you to gain extra points.

All stitching should be correct, regular, even in length when required and even in *spacing* and *tension*. Work which requires padding should be well and carefully padded, usually with a thick thread.

Most work is commenced with a few running stitches which are *covered over completely* with embroidery. There should be *no knots* and *no loose ends*. There should be *no carry over* threads from one piece of embroidery to another on the *wrong side*, the exception being French knots which cannot be ended off separately.

To end off a thread the end should be taken to the wrong side, then run through some of the stitches at the back or completely hidden inside a completed piece of embroidery then cut off closely. In fact on close inspection the wrong side should be almost as neat as the right side. Endings in most cases should be invisible, but with many stitches it is not possible to make them entirely so.

When work is completed it should be pressed. Care should be taken to press embroidery on the *wrong side only*. Press embroidery with an up and down movement. Do not run the iron over the embroidered parts. If these directions are carried out the pattern should stand out and show up to advantage on the right side.

Coloured Embroidery:

Skill is required in the choice of colours and the arrangement and blending of the colours.

Some designs lend themselves to a blending of colours. Other types of embroidery with bold designs lend themselves to rich colours and strong contrasts.

Finally if the schedule stipulates hand work, it *means handwork*.

Machine hemstitching is permissible on fancy work in preparation for a crochet edge.

MACHINE WORK

MUCH of what was said of handwork is also true for machine made articles.

The final presentation is all important. As with handwork articles should be well pressed, folded carefully and in most cases boxed. Garments should be folded with layers of tissue paper between the folds, and be presented with a fresh, untouched appearance. As with handwork laundering is not permitted.

When making a garment for exhibition purposes, select a style which is fashionable but not ultra modern. A simple comfortable style, well cut and well fitting always looks well. Care is necessary in choice of material and colour scheme, bearing in mind that styles, materials and colours which suit adults are not always in the best taste for young girls.

Styles selected for babies' clothes need careful consideration, with the emphasis on comfort for the baby.

Now we come to machine workmanship. Machine stitching should be small and regular with even tension on both sides of the work. The ends of machine threads need tying to prevent unripping. Joins in machining should have an overlap of at

least one inch immediately on top of the previous machining.

Seams should be even, and machining straight, or regular.

For exhibition purposes all garments have to stand up to a careful scrutiny *on the wrong side.* All raw edges should be neatened by overcasting with no loose ends of cotton left.

Attention is necessary for often-neglected details, the sewing on of buttons, shanking of buttons, working or making buttonholes correct methods of attaching press studs, hooks, eyes, zip-fasteners and so on.

Are you sure you know the correct way to slip hem, or that the hem on the frock is even? These are all points which if neglected will be picked up very quickly indeed by a good judge.

When making children's clothes for exhibition, as at all other times good seam and hem allowance is essential.

Trimmings should be suitable to the garments, well made and neatly finished.

Those New Kitchen Chairs

ARE you concerned about new kitchen (or dining room) chairs—those nice shining ones upholstered on to a chromium frame?

There is always the possibility that the chair backs will in time become marked through continual lifting by the back rest. To keep these in good condition make open envelopes to fit over the top. Covers may be slipped on and off in a matter of seconds.

Heavy quality clear plastic makes excellent envelope covers.

If the chair back is shaped, machine a narrow hem around the opening and insert narrow elastic. This makes the cover "hug" the chair back.

Back and front of covers may be fastened together between the bars with a couple of press studs.

If you wish to cover the chair seats with plastic, cut a paper pattern to the exact size of the seat. Add the depth of the seat plus one inch to each side.

Round off the corners from the seat pattern.

Turn in a narrow hem and sew in elastic. The elastic must be tight fitting.

Slip cover over the chair seat.

Alternatively, triangular darts may be sewn at the corners so that the cover slips over and fits without fullness.

A HINT FOR THE GARDEN

Don't throw away that old garden hose, or odd short lengths of hose not needed in the garden. These are useful for tying shrubs, saplings, rose bushes and so on to stakes to save them from wind damage.

Take a piece of hose about 12 inches or so in length, depending on the plant to be tied to a stake. Cut a piece of fencing wire six inches longer and thread through the hose, then bend each end of the wire to form loops.

The hose is then put outside the stem, and the looped ends hooked together over the stake. This will hold the tree or shrub firmly without damaging the bark.

—H.M.G.

MURESK AGRICULTURAL COLLEGE

(Department of Agriculture)

Parents are reminded that applications for 1963 admission to Muresk Agricultural College close on December 31 of this year. A preliminary selection of 1963 entrants is made after the Junior results are available early in 1962.

The successful applicants then continue with Sub-Leaving, or higher studies, in 1962.

Before the course can be commenced students must have attained:—

(a) Sub-Leaving Standard in English, Maths. A, Chemistry and Physics (including Magnetism and Electricity if possible).

(b) Junior Standard Bookkeeping.

Should places still exist for 1963 commencement after the preliminary selection early in 1962, they are filled in order of application during 1962, by qualified applicants.

Duration of Course.—Two years.

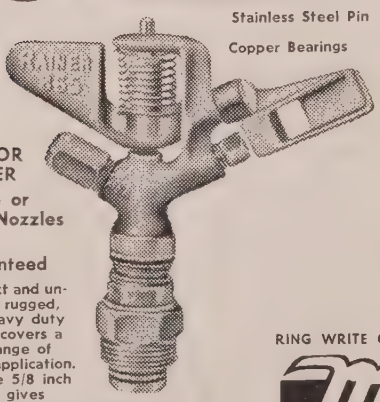
Fees.—Approximately £185 per annum covering full residential charges.

Scholarships.—Department of Agriculture (3), the "Countryman," and J. J. Poynton Memorial (2).

Boarding Allowance.—Most Muresk students are eligible for the Education Department Boarding Allowance (£50 per annum).

Full details of the College are obtainable from the Principal, Muresk Agricultural College, Muresk, W.A., or the Department of Agriculture, Perth.

BUCKNER



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Set out here is a typical performance chart of one set of nozzle sizes taken from the large range of interchangeable nozzles.

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Nozzle Sizes in inches	Pressure at Sprinkler in Pounds	Discharge in G.P.M.	Diameter in Feet	Rainfall Equivalents Expressed as inches per hour — Sprinkler spacings in feet arranged in order of area covered							
				20' x 30'	30' x 30'	30' x 40'	30' x 50'	40' x 40'	30' x 60'	40' x 50'	40' x 60'
3/16 x 1/8	25	6·3	86	1·14	·76	·57	·46	·43	·38	·34	·28
	35	7·4	93	1·35	·90	·67	·54	·51	·45	·40	·34
	45	8·3	97	1·51	1·01	·75	·60	·57	·50	·45	·38
	55	9·2	100	1·68	1·12	·84	·67	·63	·56	·51	·42

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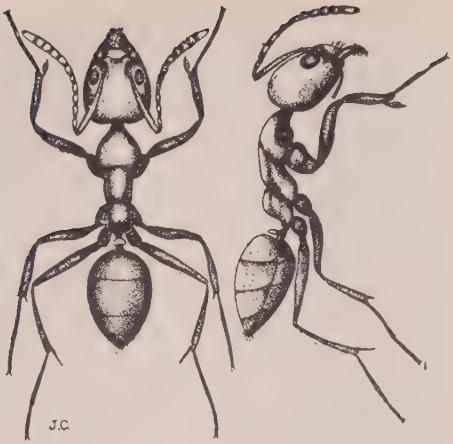
The Argentine Ant *in* WESTERN AUSTRALIA



By C. F. H. JENKINS, M.A., Government Entomologist

IN November, 1954, was commenced one of the most ambitious insect control schemes ever launched in Australia. The pest concerned was the Argentine ant (Iridomyrmex humilis) and the authorised expenditure was at the rate of £105,000 per annum for five years.

ORIGIN AND SPREAD OF THE ARGENTINE ANT

The native home of the Argentine ant is believed to be either Brazil or the Argentine Republic. It is recorded from other South American countries, however, and was introduced into the United States in about 1888. The pest is also common in South Africa and various Mediterranean countries and even infests greenhouses in England and Germany. It reached Hawaii as recently as 1941. As far as Australia is concerned, the first record of the ant was from Victoria, where it was recognised in 1939. In 1941 the pest was located at Albany and Perth and in 1950 Sydney was invaded.

HABITS AND ECONOMIC IMPORTANCE

Argentine ant colonies consist of queens, males, and workers. It is the workers which are most commonly seen and whose presence causes the actual trouble. In general appearance they resemble very closely a number of other common ants, and measure about $\frac{1}{8}$ in. in length. They are brown in colour and do not give off the so-called "anty" smell so characteristic of most ants when crushed. This is not an infallible means of identification, however, as other local species are also characterised by this lack of odour. The winged males are seldom seen, but are somewhat larger than the workers. The queens are the largest members of the colony, and unlike most of our native ant queens have a habit of foraging with the workers instead of remaining in the confines of the nest.

The economic importance of the ant varies according to the industry concerned. As a general domestic nuisance, it is without equal. As an orchard pest it ranks high because scale, aphis and mealy bugs are carefully tended by the ants in their search for honeydew. The constant ant activity is apparently resented by ladybirds and other natural enemies which normally help to keep scale and aphis in check and so the trees decline in health due to an increase in these pests. In various food industries the direct losses caused by the ant can be considerable, and before the present scheme the general expenditure on control operations had reached a large annual figure.

Typical Argentine ant trail on the trunk of a citrus tree (U.S.D.A. Photo)

Why is it that this small and not very ferocious ant has established itself so widely and is so very difficult to combat? Its communistic habits are an important factor, for large ramifying colonies gradually develop and no domestic strife between different groups arises as is the case with our native species. By sheer persistence these ants will finally oust all others, regardless of size, from their territory. The fire ant is putting up a battle in some of the southern States of the U.S.A., but it was completely pushed out of the island of Madeira by the Argentine ant, and the latter is now the only surviving species on the island.

NATURAL RATE OF SPREAD

Although the Argentine ant queens develop wings, they do not normally undertake nuptial flights, as do most of our native species, and this means that the natural spread of the Argentine ant is slow. In Bunbury it has been possible to make fairly detailed observations on what may be regarded as the natural rate of dispersal. The first infestation recorded at Bunbury was in 1948 when, as far as could be discovered, the outbreak was confined to a building and garden covering approximately $\frac{1}{8}$ acre. In 1951, less than three years later, a survey showed the area of infestation to be approximately 30 acres.

It is not the natural spread of the ant which is to be most feared, but the dissemination of colonies in pot plants, firewood, and various merchandise, which may enable the insects to become established hundreds of miles from their place of origin.

METHODS USED TO COMBAT THE ARGENTINE ANT IN WESTERN AUSTRALIA

Soon after the ant was first recorded in Western Australia, various regulations were promulgated to prevent the movement of pot plants and other suspect material from infested areas. Despite all efforts, however, the ant made its appearance in a number of country districts. (Jenkins 1948; Jenkins and Forte 1951.)

Poison baits and nest fumigation were the original methods tried for Argentine ant control and, although the fumigation of individual nests is usually effective, the dispersed nature of Argentine ant colonies gives only limited scope for the use of fumigants. Poison baits showed greater promise and for several years the United States Government formula was extensively used in Western Australia with considerable success. All ant baits have serious weaknesses, however. They require continuous attention to ensure their attractiveness to the ant, most of them are dangerous to pets and children, and the results obtained are often slow. Weather conditions and the availability of alternative food supplies also greatly affect the attractiveness of baits to trailing ants.

Field Trials with New Insecticides.

The first spraying tests for Argentine ant control, employing new insecticides were carried out in Western Australia in 1945 when a small citrus orchard was treated. It was found that when the trunk and main limbs of the tree were

thoroughly sprayed with 1 per cent. water mixture of DDT the trees remained free of ants for 7 weeks. (Jenkins and Forte 1946). Even after twice that period only very weak trails had resumed.

This experience was then applied to residential blocks, and the general efficiency of barrier spraying for Argentine ant control was established. (Jenkins 1948). The main purpose of the treatment was to apply a mixture which would leave a residue toxic to ants for a considerable time.

The success achieved by DDT in Argentine ant control and the appearance of even more potent insecticides such as chlordane, and dieldrin, marked the commencement of a new era in Argentine ant control. In 1951 a joint research programme was commenced in collaboration with the C.S.I.R.O. This investigation clearly showed the superiority of chlordane to DDT and later the superiority of dieldrin to both the former chemicals. (Forte and Greaves 1953). The encouraging results obtained from this experimental work gave support to a suggestion that a large scale eradication test be conducted and for this purpose the Mill Point area of South Perth was chosen in the summer of 1952-53. The labour was recruited and supervised by the Department of Public Health and technical supervision was given by entomologists of the Department of Agriculture. A comparable trial was also conducted at Bunbury in co-operation with the local authority. The Bunbury Municipal Council engaged and supervised the labour and costs were later recouped by the Government. (Jenkins 1953.)

The techniques used were a slight modification of the original DDT treatments and involved the spraying of road kerbs and fence lines, all building foundations, the edges of concrete paths, garden beds, the butts of trees to a height of six feet, and grid spraying at 10 foot intervals of lawns and patches of open ground. Such a spray application ensures that trailing ants will either be killed immediately or will soon cross lethal insecticide residues in their foraging parties. A two per cent. emulsion of chlordane was used in this test and, as complete eradication over an area of one square mile at South Perth and 130 acres at Bunbury was the objective, much of the area was treated twice in the season. The rate of application was approximately 75 gallons of liquid per acre for each treatment, and the total cost was £9,584.

Foreshore and market garden area at South Perth at the beginning of the campaign

In addition to about 800 household blocks which were treated during the experiment, the Zoological Gardens and a paper bark and reed swamp on the Swan River foreshore were included in order to test the spraying methods under as wide a variety of conditions as possible.

This treatment was completely successful as, although odd colonies of ants were subsequently detected in the area, these were easily dealt with and the region is now believed to be completely free of the pest.

The spectacular results obtained with chlordane in the South Perth trial and the later superiority of dieldrin, as revealed in replicated experiments conducted on household blocks at Subiaco and Shenton Park, indicated that a large scale campaign to control the ant in Western Australia was quite practicable.

FORMATION OF THE ARGENTINE ANT CONTROL COMMITTEE

Following the discovery of the Argentine ant in Western Australia in 1941, quarantine and other official control measures were at first enforced under the Plant Diseases Act administered by the Department of Agriculture.

In June, 1948, the ant was added to the schedule of the Vermin Act and in November, 1948, the insect was brought under the control of the Health Act. It was thought that this would enable health inspectors employed by various local bodies to enforce control measures within their districts.

A co-operative campaign against the ant was then conducted by the Department of Public Health and the Department of Agriculture, commencing in the summer of 1949.

Blanket spraying with two per cent. DDT was conducted at Fremantle to test the efficiency of the new chemical, and the spraying techniques so far devised. Although good control was achieved by the Fremantle spraying, it was not considered practicable to extend the scheme to all infested areas and efforts were made to arouse public interest in Argentine Ant Control and to place more responsibility on the individual householder.

During the next few years, Government funds were made available to local authorities for the spraying of streets and footpaths and to subsidise the sale of DDT sprays and ant baits to householders.

During the five years from 1949 to 1953, approximately £80,000 was provided for Argentine Ant Control, but the pest continued to spread and public agitation grew in support of some centralised campaign to replace the piecemeal methods of the past.

In November, 1953, responsibility for Argentine ant control was again transferred to the Department of Agriculture and in December, 1954 legislation for the major campaign came into force.

OPERATIONS UNDER THE ARGENTINE ANT ACT, 1954

The Argentine Ant Act to provide for the control, prevention and destruction of Argentine ants in the South-West Land Division of Western Australia received assent on December 3, 1954. Under the provisions of this Act a five year control campaign (later extended to six years by an amending Act assented to on September 29, 1958) was commenced in the summer of 1953-54 with the object of treating all Argentine ant infestations in the State.

ARGENTINE ANT CONTROL COMMITTEE

A Control Committee of five was appointed, with representatives from the following organisations:—

(a) The City of Perth.

(b) The Local Government Association of Western Australia.

(c) The Country Municipal Council's Association of Western Australia.

(d) The Road Board Association of Western Australia and The Director of Agriculture, as Chairman.

The Chief Administrative Officer of the Department of Agriculture attended all meetings in the capacity of secretary and the Government Entomologist attended to present formal reports and advise on the general conduct of the campaign.

The first Committee meeting was held on January 11, 1955, and monthly meetings were held until the expiry of the Act.

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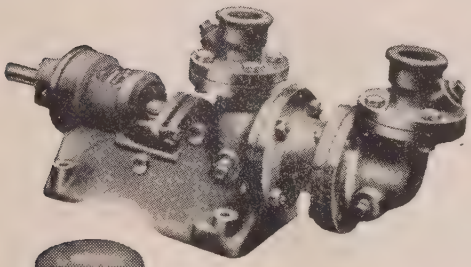

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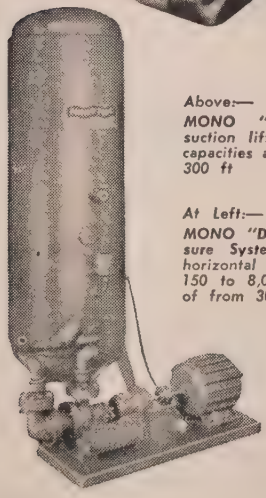

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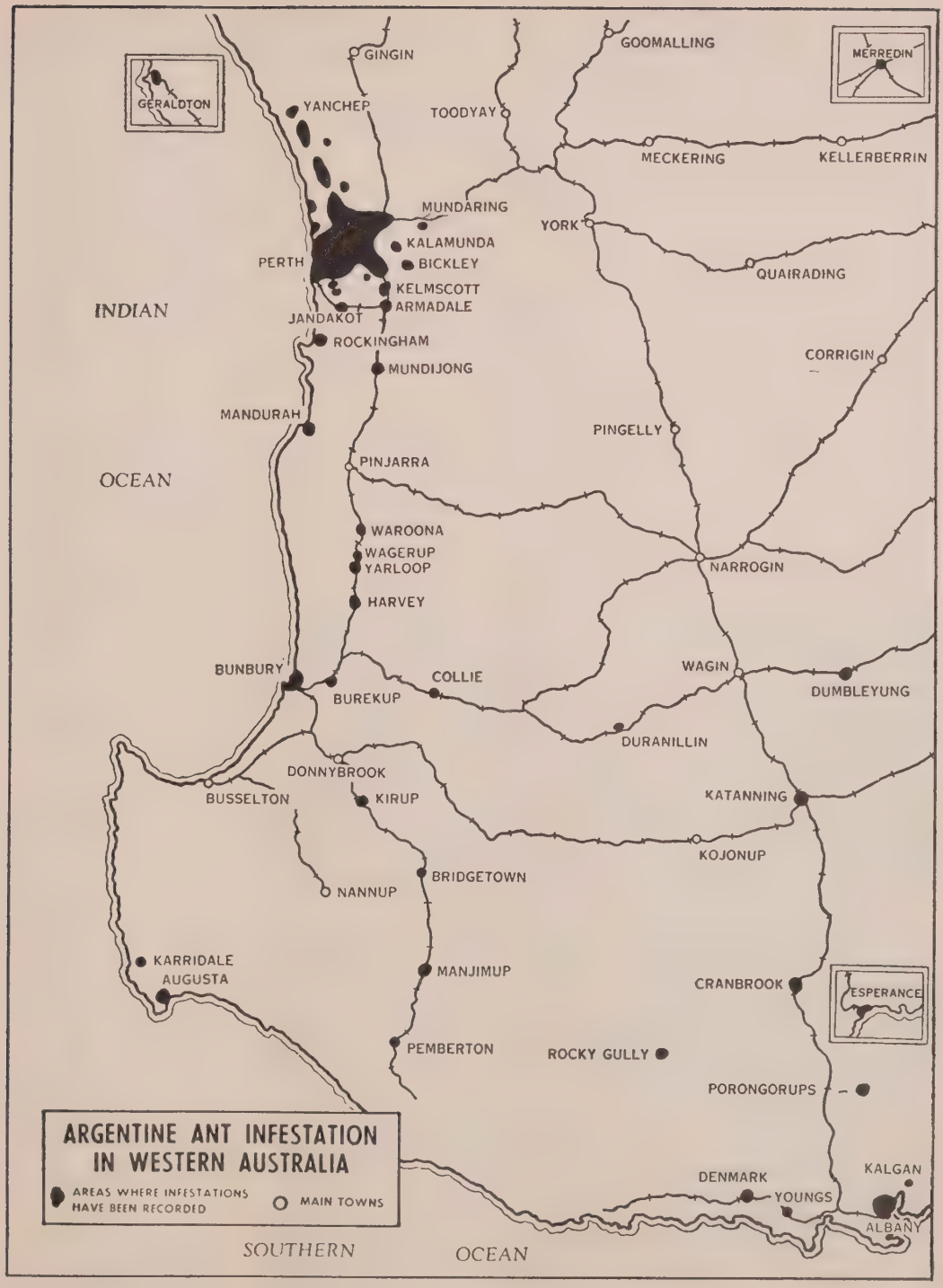
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ARGENTINE ANT INFESTATION IN WESTERN AUSTRALIA
AREAS WHERE INFESTATIONS HAVE BEEN RECORDED
MAIN TOWNS
SOUTHERN
OCEAN

FINANCE

Provision was made under the Act for finance to be provided each year by contributions from the following bodies:—

	£
Local Authorities in the South-West Land Division	66,000
Agricultural Protection Board	4,000
State Treasury	35,000
	£105,000

A contribution of £1,000 a year was also made by the Commonwealth Government to cover the treatment of Commonwealth property such as Post Offices, Banks, etc.

DISTRIBUTION OF THE ARGENTINE ANT AND THE ESTIMATED AREA OF INFESTATION

At the beginning of the campaign the Argentine ant was widespread in the city and suburbs and was also recorded from a number of country districts, the principal ones being Albany and Bunbury.

The total area of infestation was then estimated at 25,000 acres and it was hoped that this could be treated at the rate of 5,000 acres a year, but at the conclusion of the campaign in June 1960, a total of over 43,000 acres had been sprayed.

This area involved nearly 86,000 separate locations, varying from small household blocks to extensive grazing areas. All the owners or occupiers had to be supplied with leaflets giving notice of the intention to spray and setting out the procedure to be followed both for routine treatments and for the protection of livestock and household pets.

SEQUENCE OF SPRAYING INFESTED AREAS AND THE PROGRESS OF THE CAMPAIGN

Outlying and isolated ant outbreaks were treated first in order to prevent the rapid expansion and perhaps coalition of these infestations.

Preference was further given to built up areas and possible distribution points such as nurseries, wood yards, dairies and poultry runs.

Group Spraying.

In order to relieve individual householders who were seriously troubled by the ants, and were faced with waiting several years for treatment under the scheme, a system of self-help was instituted whereby knapsack sprays and insecticides were supplied to householders sponsored by their local authority and prepared to work co-operatively so as to treat groups of not less than a dozen houses.

The arrangements worked well and many people made use of the facilities offered.

Yearly Progress.

The yearly progress of the campaign is set out in the following table. (Anon 1960.)

ARGENTINE ANT CONTROL

Summary of Campaign, July 1, 1954, *to July* 30, 1960

Year	Acreage Sprayed	Man Hours Worked	Spray Laid (gallons)	No. of Locations Treated	Spray (gallons per Acre)	Man Hours per Acre	Cost per Acre
							£ s. d.
1954–55	7,246·5	78,351	481,888	10,000 (estimated)	66·5	10·81	11 0 0
1955–56	12,142·25	112,512	743,965	39,782	61·5	9·26	10 0 0
1956–57	8,754·98	80,504	570,053	17,295	65·0	9·2	11 0 0
1957–58	6,681·0	96,652·5	669,237	7,711	100·17	14·47	15 0 0
1958–59	4,320·625	89,951	610,590	6,315	141·32	20·82	21 5 0
1959–60	4,119·375	60,234	587,260	4,715	142·6	14·63	20 15 0
Progressive Total	43,264·73	518,204·5	3,662,993	85,818	84·66	11·98	13 5 0

It will be seen that in the early years (of the campaign) progress was well in excess of the estimated 5,000 acres a year and it was thought by some that the operation would be completed ahead of time. However, the discovery of fresh infestation particularly in the country and in swampy areas at Wanneroo, greatly expanded the spraying field, not only because of added acreage, but also because of the longer time required to treat wet and overgrown areas.

These factors finally made it necessary to expand the powers of the Argentine Ant Act from five to six years and to introduce a fresh act to prolong the powers of the Argentine Ant Control Committee for an indefinite period.

DIVERSITY OF SITUATIONS SPRAYED

During the campaign a wide variety of situations required treatment and special techniques were developed to meet individual requirements.

Suburban Dwellings:

The normal spraying methods already described were applicable to most dwellings but special care was necessary to protect fishponds, beehives, birds and other pets. All fishponds and aviaries were covered with tarpaulins before treatment and spraying pressures were often reduced to minimise spray drift.

Stock Paddocks and Poultry Yards:

Where possible stock and poultry were removed or confined off the sprayed areas. Where this was not possible the less toxic chlordane was often used instead of dieldrin. In some instances land owners were assisted by the provision of temporary fencing so that paddocks could be sprayed in rotation and stock moved from paddock to paddock after the lapse of a suitable safety period. One of the most specialised areas of this type treated early in the campaign was the Zoological Gardens at South Perth. The entire zoo

This photograph of a path cut through Taylorina swamp indicates the height and density of the growth

was successfully sprayed without detrimental effects to any of the exhibits.

Market Gardens and Orchards:

In some instances it was necessary to spray down the individual rows of vegetables but in other cases a barrier treatment around each bed was satisfactory. Special care was necessary to prevent the contamination of vegetables and damage by the long hose lines as they were dragged through the crops.

The butts of all trees in infested orchards were thoroughly sprayed and in the case of severe outbreaks treatment was also applied to the main limbs.

Swamps and River Foreshores:

Several thousand acres of swamp country, including river foreshores, were heavily infested with ants. The insects flourished in the dense reed growth and paper bark (*Melaleuca spp.*) thickets and often trailed long distances through the interlocking foliage. In many instances permanent nests were established under the bark of trees and in hollow branches well above the water.

Access to these difficult areas was gained by boat, flat bottomed punt and by wading.

City Premises:

The treatment of the main city block (from Wellington Street, to the Esplanade and from Pier Street, to Milligan Street), presented special difficulties because of the traffic problem and the need to disrupt business as little as possible. The spraying of streets, lanes and footpaths was carried out from dawn until about 7 a.m., when traffic prevented further activity. Individual business premises were then sprayed on a Sunday morning after prior arrangement with the occupiers. Treatment included the exterior foundations of all buildings as well as the bases of all light and lift wells and the walls of courtyards and loading areas. The entire operation was completed between 7 a.m., and noon with the employment of 65 men and 20 spray plants.

GALLONAGE AND COST PER ACRE

The rate of spray per acre, the time for treatment and therefore the cost per acre varied enormously according to the situations involved. Rates of approximately 40 gallons per acre were found satisfactory for clean household blocks, but in thick swamp country with paper bark trees and reeds eight to 10 ft. high the output was sometimes in excess of 800 gallons to the acre.

The table summarising the progress of the campaign sets out the average spray output and the cost an acre season by season.

LABOUR FORCE AND ORGANISATION OF SPRAY TEAMS

It was the practice during most of the campaign for the labour force to be employed by the Local Authority in whose area work was being performed, but for all costs to be recouped from the Ant Committee funds. The men were trained in spraying techniques and supervised by entomologists of the Department of Agriculture.

Each spray team normally comprised two spray hands and a senior hand and every group of six teams was controlled by a supervisor, and usually a foreman. The importance of adequate supervision was clearly reflected in the varying results which were obtained where, for unvoidable reasons, supervision was lax.

The labour force employed each year varied with circumstances but at the height of the campaign 170 men were employed on spraying and surveying.

During the off season key supervisors were retained for maintenance work on the equipment and to ensure that a nucleus of experienced men were available for the next season's operations.

EQUIPMENT AND MATERIALS

Spray Units:

The standard spray unit comprised a Moffatt-Virtue Roller pump and a 1 h.p. Villiers engine. This was mounted on a cut-down 44 gallon drum, with a capacity for 20 gallons of spray material, and carried on a three wheeled pneumatic tyred trolley 2 ft. 6 in. wide. These units fitted with two 100 ft. lengths of hose could be manipulated easily through garden gates and about suburban premises. They could also be mounted on boats and pontoons for use in swamp areas.

Spraying unit showing pneumatic tyred trolley carrying 44-gallon drum and power spray

Vehicles:

Up to 30 vehicles were used during the summer months to transport men and equipment to assist in spray work, and for surveying. Four Land Rovers were fitted with spray units, 200 ft. lengths of hose and 80 gallon tanks to treat difficult areas and to assist in water carting.

Two small crawler tractors (Ransome 5-6 h.p.) fitted with special swamp tracks were used to make paths through dense vegetation such as reeds and bamboos and to give access to spray units and personnel.

An 18 ft. pontoon, a smaller pontoon and a pram dinghy were also used to support equipment and/or personnel when work was being done along the Swan River and Canning River foreshores and in swampy areas.

Materials:

The standard spray hose used was $\frac{3}{8}$ in. two-braid agricultural spray hose. Several types of plastic hose were also tested.

Normal spraying for ant control was carried out with 0.5 per cent. dieldrin, but where there was any danger to livestock or pets the less toxic 2 per cent. chlordane was used.

PUBLIC RELATIONS

Throughout the campaign the various Local Authorities cooperated willingly with the Argentine Ant Committee and its personnel and contributed materially to the good relationships maintained with the public during the six years of difficult work.

The owners and occupiers of premises were given written notice of intention to spray and were supplied with circulars setting out their responsibilities with regard to preparing for the spray teams, the protection of pets and other animals, and the non interference with sprayed surfaces.

Spray hands and supervisors were also briefed on the hazards associated with the spray treatments and the necessity for maintaining good public relations.

HAZARDS TO HEALTH, LIVESTOCK, PETS AND GROWING PLANTS

Dieldrin and Chlordane are toxic to man and the lower animals both by contact and by ingestion. Detailed tests were carried out in conjunction with the Chief Veterinary officer and the staff of the Government Chemical Laboratories to determine the dosage which could be

Barrier sprays being applied along boundary fence and street kerb

expected to kill sheep and fowls, and the rate at which residues would disappear from sprayed herbage.

Under the conditions of the experiment the residue from 0.5 per cent. dieldrin sprayed at 200 gallons an acre on rank couch grass disappeared gradually over a period of three months. The residue from 2 per cent. chlordane in a comparable situation could not be detected chemically after three weeks. In areas where very heavy applications of insecticide were necessary and where rates of up to 800 gallons of 0.5 per cent. dieldrin an acre were applied, residues were detectable after 12 months and some horses and cattle died from the ingestion of contaminated material. There was evidence to suggest that horses chewing the bark of trees such as Paper Barks (*Melaleuca spp.*) which were often saturated with spray, were affected by dieldrin poisoning.

Fish are highly susceptible to dieldrin and chlordane and the slightest contamination of the water will cause deaths.

Where it was not possible to remove the fish, the ponds were covered with tarpaulins or other sheeting and pressures were lowered to reduce the chance of spray drift. Comparable precautions were taken in the case of aviaries.

Formulations were carefully tested for their effects on growing plants, and foliage damage throughout the campaign was negligible.

SPECIALISED SPRAYING TECHNIQUES

The standard method of spraying for Argentine ant control is to carry out boundary spraying around each individual infestation to prevent extensive migration from the area as the normal treatment progresses. Insecticide is also applied to the outside foundations of all buildings, the edges of garden paths and flower beds, the butts of all trees and shrubs, the base and cross rails of fences as well as individual posts. Open areas are gridded in 10 foot squares.

In very thick vegetation however, this type of spraying was ineffective and the liquid was applied as a strong jet as near to the ground as possible and as a complete cover treatment. Such applications sometimes required over 800 gallons of spray mixture per acre.

Large trees were treated to a height of at least six feet and, where possible, as high as the lower branches. Trees in Paper Bark (*Melaleuca spp.*) and Taylorina (*Psoralia pinnata*) thickets were given individual attention and where necessary

All open spaces—such as lawns and roads—were "gridded" with spray bands in 10 ft. squares

the leaf canopy was gridded to prevent ants trailing above the ground.

There was some evidence to suggest that insect and other food available amongst turf made it possible for some ants to survive without trailing long distances. For this reason extensive areas of lawns were often sprayed in 5 ft. squares to prevent the possibility of individual nests surviving in the standard 10 ft. grids.

SURVIVALS

In ordinary suburban surroundings, spray treatments were highly effective and surviving colonies were very few. In swampy areas and particularly where restricted spraying was practised because of stock hazards, the proportion of survivals was much higher. The very efficiency of the materials used however, complicated the detection of survivals and made it necessary to re-survey areas in successive seasons. In dense swampy growth, it was possible to remove all signs of ants with a single treatment only to find survivals present the following year. In such instances, it is believed that isolated and very weak colonies persisted and escaped detection until after a season or more, their numbers were able to increase and so become noticeable once again.

A remarkable instance of the ant's powers of survival was observed during the winter of 1958. Several hundred acres of infested flats at Guildford were completely inundated and logs and fence posts in the areas were under water for three weeks. Ants congregated in isolated trees were sprayed and inspections were made as the water receded. Ants were found on several posts and logs recently exposed by the subsiding waters, the colonies having apparently survived in air-locks trapped in deep cracks and hollows in the wood.

Paperbark trees receiving spray treatment

THE EFFECT OF SPRAYING ON USEFUL INSECTS AND OTHER FORMS OF WILD LIFE

The view has been widely expressed that the removal of the Argentine ant from large sections of the metropolitan area has been responsible for a great increase in many household garden pests, and particularly house flies.

There is no doubt that like most ants, the Argentine ant is a scavenger and that consequently it would remove much material suitable for fly breeding and may devour some of the maggots themselves.

On the other hand, Dieldrin and Chlordane have been widely recommended for fly control and could be expected to reduce fly activity immediately after spraying. This actually occurred in many areas and although the house fly problem has been quite intense in recent years, no valid evidence has been produced to link this with the Argentine ant campaign.

As far as other pests are concerned, there is some evidence to suggest that certain caterpillars, springtails and perhaps cockroaches increased, possibly as a result of parasite destruction, but the picture was somewhat confused due to the fact that outbreaks were not always restricted to sprayed areas.

The reduction in certain insectivorous birds particularly Willy Wagtails, was also alleged following the ant spraying, but although some deaths did occur where birds were noted to fly into the spray mist, the general bird population was not seriously affected.

Where heavy spraying was carried out in swamp country, some water birds were unfortunately killed, and dead foxes, rats and snakes were also noted. Frogs suffered heavily, both in swamps and home gardens. The burrowing frog (*Helioporus eyrei*) once common in metropolitan gardens, has diminished greatly in numbers, probably due to Argentine ant spraying.

It was anticipated that some temporary upsets in the natural balance might follow large scale spraying of Dieldrin and Chlordane and in fact this matter was investigated during and after the experimental treatment at South Perth.

Although the immediate results were in some cases quite spectacular there was nothing to suggest that such upsets

would be permanent, and in fact conditions in most areas have returned to normal, with the possible exception of the frog population.

FUTURE POLICY IN THE LIGHT OF THE SIX YEAR CAMPAIGN

"The Argentine Ant Act Amendment (Continuance) Act, 1958" expired on June 30th, 1960, and was replaced by the "Argentine Ant Act, 1959". This Act provides for the original Argentine Act Control Committee to remain in office and for the powers authorised under the "Argentine Ant Act, 1954-58" to be retained.

Finance for Argentine ant control under the new Act will be borne by the Government.

CONTAINMENT PROGRAMME

At the termination of the six year Argentine Ant Campaign on 30th June, 1960, less than 1,500 acres of known infestations remained to be treated. Of these approximately 1,350 acres of swamps will be left untreated or partly treated where there is no likelihood of spread to clean areas, and precautionary barrier spraying along the boundaries of the infested areas will be carried out.

Strict periodical inspections of adjacent market gardens will be made and the movement of manure from these areas will be carefully controlled, or restricted where the possibility of spread exists.

THE ACHIEVEMENTS OF THE CAMPAIGN COMPARED WITH THE ORIGINAL OBJECTIVES

At the outset of the main campaign in 1954 the possibility of total ant eradication was carefully investigated but it was decided that with the funds available this was not practicable.

The main purpose of the programme was the removal of the Argentine ant as a general nuisance from the metropolitan and country districts and the prevention of its re-establishment in such situations.

The main objectives of the programme have therefore been achieved, despite the fact that the total area of infestation was finally estimated to be 45,000 acres instead of the original 25,000 acres.

Adequate powers exist under the Argentine Ant Act, 1959, to deal with future ant infestations and Government finance is available to maintain "care-taker staff" to carry out inspections and treat danger spots. Future success however, will be greatly influenced by the degree of public interest which is maintained in the Argentine ant problem and the readiness with which suspect outbreaks are reported.

ACKNOWLEDGMENTS

The success of the Argentine Ant Campaign indicated clearly the advantages of centralised control combined with widespread co-operation. Before the launching of the campaign, co-operative experimental work between Entomologists of the State Department of Agriculture and the C.S.I.R.O. demonstrated the efficiency of modern chemicals such as chlordane and dieldrin. Close co-operation between the State Department of Agriculture and the Department of Public Health in field trials proved the practicability of the spraying techniques on a large scale and co-operative planning by officers of these two Departments laid the foundation for the final scheme.

During the actual campaign, the various local authorities involved were most helpful and with very few exceptions, the general public gave the fullest co-operation.

A tribute must also be paid to the spray personnel and their supervisors who often worked under the most trying conditions. The Officer in Charge of the Argentine Ant Depot, Mr. F. Broomhall, deserves credit for the general organisation of all labour and the liaison which he maintained with local authorities. Great credit is also due to Mr. P. N. Forte for his supervisory work in the field and keenness shown during the entire campaign.

REFERENCES

ANON, 1960.—Annual Report, Argentine Ant Control Committee.

FORTE, R. N. and GREAVES, T., 1953.—"New Insecticides for the Control of the Argentine Ant in Western Australia". *Journ. Dept. Agric. West. Aust.*, Vol. 2 (3rd Ser.), p. 267.

JENKINS, C. F. H., 1948.—"The Argentine Ant". *Journ. Dept. Agric. West. Aust.*, Vol. XX (2nd Ser.), p. 101.

JENKINS, C. F. H., 1953.—"Fighting the Argentine Ant". *Journ. Dept. Agric. West. Aust.*, Vol. 2 (3rd Ser.), p. 631.

JENKINS, C. F. H., and FORTE, P. N., 1946.—"1945-1946 Experiments with DDT and 666 as Agricultural Insecticides". *Journ. Dept. Agric. West Aust.*, Vol. XXIII (2nd Ser.), p. 311.

JENKINS, C. F. H., and FORTE, P. N., 1951.—"The Argentine Ant in Western Australia". *Journ. Dept. Agric. West. Aust.*, Vol. XXVIII (2nd Ser.), p. 324.

Argentine ant infestation in Perth and surrounding districts. Areas where ants have been recorded are coloured black. These areas are now virtually free of Argentine ants.